SCIENTIFIC AMERICAN

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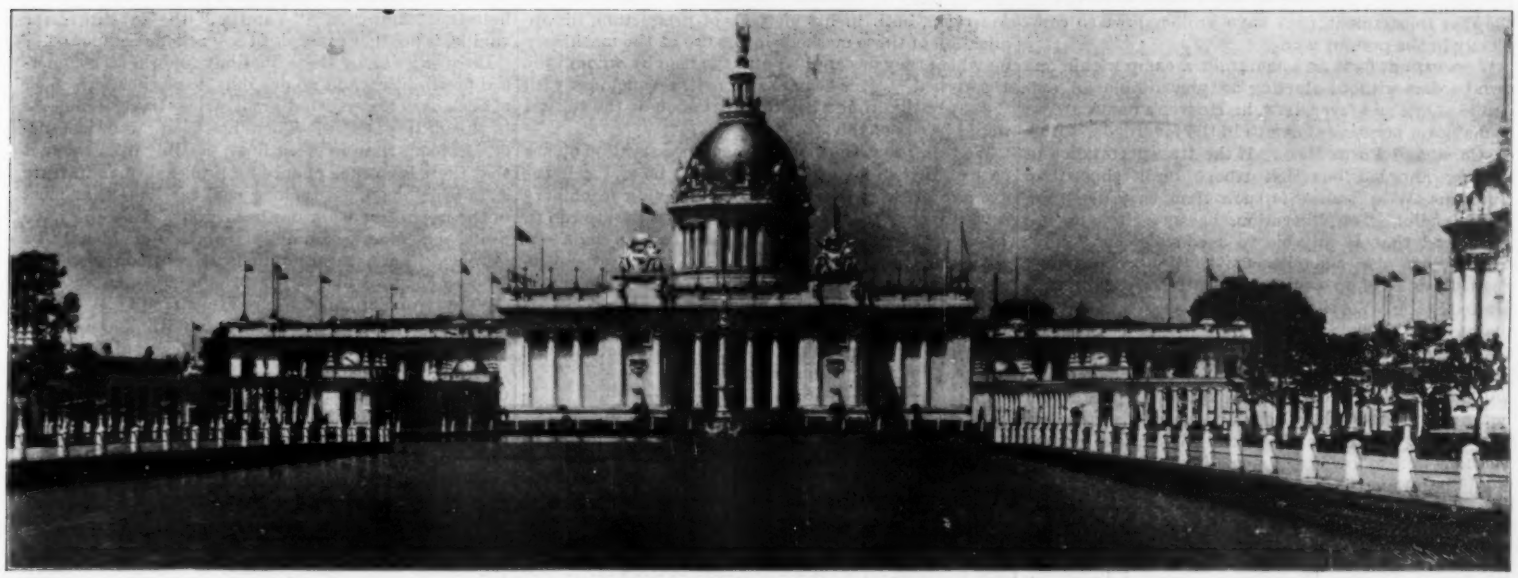
PORTION OF FISH COMMISSION EXHIBIT—ENTRANCE TO GROTTO.

DOME OF THE GOVERNMENT BUILDING.

SMITHSONIAN INSTITUTION AND NATIONAL MUSEUM EXHIBITS



UNITED STATES GOVERNMENT BUILDING—FRONT FACADE.

THE GOVERNMENT EXHIBIT AT THE TRANS-MISSISSIPPI AND INTERNATIONAL EXPOSITION.—[See page 168.]

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THE WAR DEPARTMENT AND OUR NEW FOREIGN POLICY.

It did not require the test of the late war to prove the mettle of the American soldier, or the skill and heroism of the officers that led him into battle; but it did require just such a test to open the eyes of the American public to the woeful incapacity and confusion that reigns in certain branches of the War Department. With all the accumulated experience of the great Civil War to go upon, our quartermaster, subsistence, and medical departments should have been among the most efficient in the world. They were popularly supposed to be so, and the public never doubted, when war was declared, that in the transportation of troops, the bringing up of supplies, and the care of the sick and wounded, we should show something of that characteristic order and method which has contributed so largely to our present industrial supremacy.

The public was doomed, however, to a bitter and humiliating disappointment. The confusion that existed from the first in the Southern camps was merely a prelude to the scenes of inexcusable suffering and neglect which marked the progress of the campaign and the melancholy home-coming of the troops at its close.

Nor can the department be absolved of all blame because great results were actually achieved in the few months of the war. The same results could have been achieved, and should have been, without the terrible accompaniments of neglect and starvation that are causing a thrill of anguish and indignation to pass from one end of the country to the other. The performance of one duty does not atone for the total neglect of another, and the demand of the public for a searching and impartial investigation is both reasonable and just.

Apart from its moral aspects, however, there is another consideration of a very practical nature which makes it imperative that the investigation should be set on foot at once. We refer to the portentous change which has taken place in the foreign relations of this country, and the widespread and complicated field of naval and military operations upon which the nation has entered.

Cuba, with its diverse and bitterly opposed races to be pacified and garrisoned; Porto Rico to be held as England holds Jamaica; Hawaii, in the mid-Pacific, and the Philippines, 8,000 miles away in the Southern Seas, are all likely to become the outposts of military activities, which have hitherto been confined to our own borders and represented by a mere handful of 25,000 men. If the wish of a considerable section of the American people is fulfilled, we shall find ourselves embarked upon a colonial policy which will demand the very highest efficiency in those very branches of the War Department that have broken down so completely in the present war.

If we cannot form and maintain a camp within our own borders without starting so preventable an epidemic as typhoid fever, how, in Heaven's name, are we to maintain permanent camps in the fever-laden towns of Cuba and Porto Rico? If the transportation and nursing afforded our sick troops on a short trip from the West Indies is such that they die, soon after landing, "of starvation, because they do not have food that is suitable to a convalescent," how, we ask, are the convalescents to be brought over the 8,000 miles of ocean that separate Manila from the United States? Yet the work of transporting troops and maintaining them in garrison duty in some of the deadliest climates in the world, of bringing home the sick, of transferring garrisons from one island to another, will have to be carried on continuously as part of our control and administration of these newly acquired possessions. Does any one doubt that, if our present methods were followed, the mortality among the troops would be a repetition of that which is now carrying off our soldiers by the hundred?

Our War Department stands in need of immediate and sweeping reform. This reform is necessary for the double purpose of visiting condign punishment upon the parties who are answerable for the present mortality among our troops and of placing the department on a footing which shall enable it to cope successfully with the grave military problems of the future.

AMERICAN PROGRESS IN ENGLISH INDUSTRIES.

The success that has recently attended American competition in those markets of the world which have been hitherto exclusively controlled by the English manufacturers has awakened a reasonable expectation that we would in the course of time obtain a foothold in Great Britain itself.

It now appears on the statement of no less an authority than The Engineer, of London, that the invasion of British markets has not only commenced, but is in very active and aggressive operation. Under the title "American Progress in English Industries" our contemporary gives a very candid review of the situation, which opens with the significant admission that British industry is pressed harder by this country than by Germany—a fact which will be surprising to those who are aware of the inroads which German competition has been making on the British industries.

The article carries special weight appearing in the columns of a conservative journal which has all along professed to make light of the "bugaboo" of foreign competition, and has endeavored to allay the fears of the manufacturers, which, as it now appears, were only too well founded. We publish the article in full in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, and must be content to mention here a few of the leading facts adduced in proof of the reality and threatening character of our competition.

A Sheffield manufacturer is quoted as saying that it is best for Englishmen to realize that America is sending over in the regular way of business heavy consignments of steel. American steel is being sent to London and in large quantities to Birmingham. It is preferred for anything that can be made in large quantities by automatic machinery. The manufacturer finds it lower in price, and the workman likes it because its uniform temper renders it easy to be worked smoothly right through and with less wear on the tools.

The writer of the article was shown, in Sheffield, a consignment of American files, just received by a local manufacturer, which cost considerably less delivered in Sheffield (the home, by the way, of the British file industry) than those of domestic make. Moreover, many of the workmen prefer the American files for certain classes of work, and the quantity received in London and Birmingham is stated to be much greater than is generally supposed.

In Birmingham the British manufacturer is using American made brass, "because it is drawn so much truer than the English that it can be worked in automatic machinery with less trouble and greater economy." To these advantages is added that of cost, the American product being from 15 to 20 per cent cheaper. Steam India rubber hose piping, according to another manufacturer, is laid down on his premises from 20 to 25 per cent cheaper than it can be bought in the English markets.

It seems, moreover, that in the smaller sizes of malleable castings we are in a fair way to capture the trade, for not only can they be laid down in Sheffield at fully 30 per cent below the local prices, but (more significant than their cheapness) the workmen themselves openly confess their preference for the American production, on account of its truer and more uniform quality. The large industrial establishments, moreover, unable to obtain what they want in England, are adopting American labor-saving machines in large quantities, and admit that they would not be without them.

Our contemporary is correct in the assumption that the business of supplying these American inventions to British industries is only just beginning. It frankly admits that "there is no denying the advance of the American, both in his methods of production, his application of those methods in the use of the machinery by which they are applied and the men by whom they are worked." This remarkable article concludes with the suggestion that a healthy discussion of the subject would be seasonable.

We think that the first act of self-preservation on the part of British manufacturers should be to teach the average British workman that labor-saving machinery is worthless without a labor-saving workman to run it. The great struggle of last year, known as the engineers' strike, was fought out over this question, and the principle was established by the collapse of the trade unions in their attempt to limit the output of machinery. It will be interesting to see whether the British workman has yet grasped one of the chief, if not the chief, secrets of our industrial pre-eminence.

ARTIFICIAL FOODS.

The announcement that Prof. Lilienfeld had read a paper before the International Congress for Applied Chemistry, at Vienna, on the artificial production of albumen has made a profound impression on both scientific and lay readers. It has proved a boon to the papers, which have begun to settle down into midsummer dullness, after the stirring days of the war. It has given them an opportunity to reel off column after column, with such captions as "We Will Get Along Without Meat," "Dining à la Tablet," "Aliment per Capsule," and equally sensational headings which the subject hardly warrants. It will doubtless prove interesting to some of our readers to examine a few statements which have been made, and to see what has actually been done.

Dr. Lilienfeld in his paper describes the artificial synthesis of albuminous substances which form an essential element of nitrogenous foods. He found it possible to prepare pepton hydrochloride by the condensation of phenol and glycocoll with phosphoric oxychloride. The substance thus obtained gives all the reactions of albuminoids. The lecturer demonstrated the preparation and properties of the new compound. By previous conversion into the sulphate and decomposition of the latter, free pepton was obtained which resembled both in its chemical and physiological behavior the natural pepton from albumen. The analytical data corresponded with those given by natural pepton. From what has been said it will be seen that Dr. Lilienfeld does not claim to have made albumen by synthesis, but to have made pepton a digestion product of albumen. Chemists will not be readily convinced that pepton has been really synthesized, as a proteid molecule is so complex, mobile, and of such high instability that a change in its constitution may readily be brought about, so that until more definite tests have been made, and until Dr. Lilienfeld pleases to give more of the details of his processes, which he holds secret at present, pending the issuance of a patent, chemists will be apt to suspend judgment.

Even if artificial albumen may be produced at a moderate price, it does not necessarily follow that it will in any way tend to solve the problem of food supply, and we are not sure as yet that the new product is physiologically identical with that produced in Nature's laboratory. Pure albumen has been made on a large scale and it is not at all dear, but we are not aware it has ever occupied an important position, in dietetics or that it has been proposed as a substitute for ordinary articles of food; so that it is really absurd to think the time will come when we shall carry about a complete meal in a pill box, and, like the artificial diamond, Prof. Lilienfeld's discovery may not be valuable from a commercial point of view, certainly not while glycocoll is selling for some $75 a kilogramme.

The subject of chemical synthesis is an important one, and in Germany alone in scores of laboratories chemists are actively experimenting along this line, which has in the past yielded discoveries which have netted large fortunes. Substances which were formerly produced only by the slow processes of Nature are now "built up" in laboratories and the products successfully meet every test.

The peculiar thing about these synthetic products is that they are far less costly than those which are made from the organic substance, usually a plant. If the substance to be produced is an extract, instead of crushing and distilling the plant or bean, the chemist proceeds to make up his product working backward, as it were. It is only necessary to cite one example of such a process. Take artificial flavoring extracts, for instance. Raspberry essence may be made by taking 4 parts of glycerine, 1 part nitric ether, 1 part aldehyde, 5 parts ethyl acetate, 1 part ethyl formate, 1 part ethyl butyrate, 1 part ethyl benzoate, 1 part ethyl œnanthate, 1 part ethyl sebacate, 1 part methyl salicylate, 1 part amyl acetate, 1 part amyl butyrate, 5 parts tartaric acid, 1 part succinic acid. These various chemicals are added to 100 parts of alcohol. This gives an excellent imitation of the flavor of the raspberry, and it is largely by such formulas as this that our artificial fruit essences which are sold to such a large extent are made. Those who have refined taste in the matters of fruit flavors are not deceived by such imitations, however. "Vanillin," the substitute for vanilla, is another example of a synthetic compound.

Discoveries along these lines have enormous commercial possibilities, and no one outside of the active field of chemistry knows what great strides have been made in chemical synthesis. There has been rather less success in foods than in other lines, possibly from the fact that there is no such chance for profitable manufacture as in technology. It is along coal tar lines that most of the important work has been done. Now we have drugs and colors which a few years ago could only be obtained from natural products at enormous expense. Modern chemists find laboratories freely open to them, especially in Germany, where every facility is offered to them in the hope that finally they will make an important discovery. One German professor of chemistry is said to have made over $40,000 in a single year on one coal tar product. Indigo is successfully produced artificially, and alizarine has replaced madder root for a red color, and is now used as a base and can be combined chemically to get any color. Chemists have also succeeded in making artificial morphine, and they have been able to make artificial caffeine, the essential principle of coffee.

The new coal tar drugs have taken a most important and aggressive position in modern medicine. The alkaloids which were formerly extracted from various plants are now made in the laboratory. Oil of

wintergreen is produced artificially, and the bitter almond oil is even better than the natural product, as it contains no prussic acid. Artificial sugar, not saccharin, has been produced in the laboratory, but not on a commercial scale, and artificial alcohol has also been made. There are great possibilities in the utilization of by-products and waste products of all kinds. One chemist has recently discovered the means for utilizing the spent yeast of breweries in the making of a meat extract substitute.

Let us hope the day will never come when the older methods of eating with which we are familiar will be superseded by artificial foods, though this would please our vegetarian friends. If we had fifty articles of diet like artificial albumen, there is no reason to believe that we should be any better off than we are at present. Indeed, we would probably require almost as much food as we do now for the waste material which the human economy requires. Artificial foods have never been very popular, and are not considered very healthy. It is very probable that if the time ever comes when a considerable portion of our food is produced in the laboratory, the world will be attacked by such an epidemic of dyspepsia as it has never before seen.

Food is both an index of the civilization attained and a factor in the attainment, and as eating and drinking became a finer art, life became more refined and manners more attractive. There is, indeed, a sentimental side to it, and while living would be immensely simplified, the great institution of society, the dinner, would soon become a thing of the past and Brillat-Savarin would become as antiquated as Lycurgus. We would indeed "return to nature" with a vengeance, but not in the way of which Rousseau dreamed. The subtle delights connected with all our favorite dishes would soon evaporate, and we doubt if we could endure very long to have our food produced in the laboratory of some great syndicate instead of in our own private laboratory—the kitchen.

THE ARMAMENT OF OUR NEW WARSHIPS.

On another page we publish the official drawings and a digest of the findings of the Naval Board which examined the wrecks of Cervera's fleet. We wish to draw particular attention to the tabular analysis of the gun-fire of our fleet, showing the number of hits made by each caliber of gun, and the ratio of the number of hits to the number of guns engaged for each caliber. The data contained in the table is among the most valuable of all that has been gathered during the war, and it is to be hoped that it will exercise a powerful influence upon the designs for newer and more up-to-date ordnance which we presume are being prepared by the Bureau of Ordnance for the armament of our future warships.

In the comparison of the relative efficiency of each caliber and type of gun, as shown by the ratio of hits scored to number of guns employed, it must be borne in mind that the table takes no account of the number of shots each gun fired—it is based merely upon the hits actually scored and the number of guns that could be brought into action. However, as the Spanish cruisers were at all times within range, at least of the large guns, it is reasonable to suppose that all of the guns that could be brought to bear were actively engaged throughout the whole of the engagement, and that the number of hits for each gun is a test of its relative efficiency.

The figures in the table are a powerful indorsement of the rapid-fire type of gun. Commencing with the "no hit" record of the 13-inch gun, and $\frac{88}{100}$ hit per gun for the 12-inch, there is an increase as the caliber diminishes, the 5-inch rapid-firer scoring 2½ hits and the 4-inch rapid-firer 4 hits per gun. The low figure for the 1-pounder is due to the range being too great, and in a less degree the 6-pounder was similarly affected.

Evidently then we ought to aim at reducing the weight and increasing the rapidity of the heavier armament of our warships. As we recently pointed out, 10-inch 30-ton guns are being built of equal penetrating power to our 13-inch 60-ton guns, and there are 8-inch 18-ton guns whose penetration is equal to that of our 10-inch 27-ton guns. The smaller modern guns are not only more rapid in their fire, but their trajectory is much flatter and the chances of scoring a hit are that much better. If only a few out of every hundred shots fired reach the mark, it is an obvious advantage to fire the largest number of shots in the shortest space of time, and for this kind of work a gun that weighs over 30 tons is altogether too slow. In view of the terrific destruction worked by such 8-inch shells as did land on the cruisers, it would seem desirable to retain this caliber on our future ships, especially as an 8-inch rapid-firer can now be built that will deliver 4 or 5 shots per minute.

LANGUAGES OF THE PHILIPPINES.

According to a Spanish missionary, who resided eighteen years in the Philippines, there is no language that is common to all the islands, but each canton has a dialect peculiar to itself. All these dialects, however, have some affinity, somewhat like that which exists between the Italian dialects of Lombardy, Sicily, and Tuscany. On the island of Luzon there are six dialects, some of which are current in the other islands. The most universal are the Tagala and Bisaya. The latter is very coarse, while the former is more polished and peculiar, and to such a degree that a Roman Catholic missionary who had a thorough knowledge of everything pertaining to the islands was accustomed to say that the Tagala language had the advantages of four of the principal tongues of the world: that it was mysterious, like Hebrew; that it had the articles of the Greek, as well for appellations as for proper nouns; that it was as elegant and copious as Latin; and that it was as well adapted as Italian for compliments and negotiation.

The natives make use of but three vowels, and have but twelve consonants, which they express differently by placing a dot above or below them. They have learned from Europeans to write from left to right, instead of from top to bottom, as they formerly wrote.

Palm leaves were formerly used for paper, and an iron style for a pen. They use writing for correspondence only, as they have no books of science or history. The missionaries have had religious works printed in the various dialects of the islands.

The natives of the Moluccas have a very pleasing way of corresponding with their friends. They arrange flowers of different colors in a bouquet in such a way that the receiver understands, by examining the varieties and their shades (which represent so many characters), what his friend intended to say to him.

THE UNDEVELOPED RESOURCES OF CUBA.

Whether Cuba becomes permanently a part of the United States or not, American brains and capital will largely contribute toward the development of many hitherto unsuspected resources, and the island that has so long suffered from misrule may be expected to blossom as the rose. Probably no more promising field for making money through legitimate and wisely directed toil has presented itself to the American youth in this century than does the "Pearl of the Antilles," now that the last vestiges of Spanish oppression have disappeared.

While sugar and tobacco have been the principal commercial products of Cuba, their importance may soon be equaled by others less generally known. The soil and climate of Cuba are eminently adapted to all tropical fruit and vegetable culture. In fact, these products grow so luxuriantly and naturally there that the natives raise all they need for home consumption without any effort. Bananas grow wild in the most extravagant manner, but the variety is poor and needs only a little scientific culture to make it equal to any imported into the United States. We import some 15,000,000 bunches of bananas into this country every year, and Cuba could produce every one at a nominal cost. Probably the banana, next to the cocoanut, is the best poor man's fruit. It grows without much cultivation, and hence it is the lazy man's fruit as well. But when we come to oranges and pineapples, it is quite a different matter. These two fruits require cultivation and the most careful handling from the time the plants are started until the fruits reach market.

The Cubans and Spaniards were never willing to pay the price of labor and attention required to make the raising of pineapples and oranges profitable. Long before the war the industry, such as it was, had drifted into the hands of Americans, who systematically cultivated a few plantations, and shipped their products to the United States. The native owners of an orange grove would gather their fruit by shaking the trees or rapping the limbs with poles. Fruit thus harvested and shipped to this country was naturally in poor condition, and half the cargo would decay on board the steamers. The oranges were packed in barrels with th same utter disregard for their tender qualities, and less system was employed in this work than an American would give to potatoes.

It was only natural that shipping oranges to the United States under such conditions should prove unprofitable, and that in time energetic Americans should go into the business and raise and ship oranges at a good profit. Oranges grow as easily in Cuba as they do in Florida or California. There are thousands of semi-wild groves scattered throughout the island which produce fruit so inferior that they are of little value for market purposes. These trees, however, can be budded and grafted with fine Florida oranges, and in two years they can be made to yield large crops of exquisitely flavored fruits. There is an opportunity for making a fortune in securing these neglected trees such as the early growers found in Florida when they first realized the value of the wild Indian orange trees.

The pineapples of Cuba can be raised to perfection. The famous Porto Rico "sugar loaf" pines can be duplicated in Cuba. People never realized what enormous and delicious "pines" could be produced under good cultivation until the London gardeners raised them in hothouses. Two years ago these magnificent pineapples from London hothouses were imported into this country, and sold as high as $3 and $4 apiece. They were as superior to the ordinary pineapple as a modern Florida orange is to the semi-wild product of the old Indian groves. It is believed that fully as fine pineapples can be raised in Cuba as ever came out of an English hothouse. The soil, the climate, and all other conditions are favorable to the perfect development of the fruits, provided the owner is willing to give the necessary labor and intelligence required for the production of all fancy fruits. It is this knowledge and skilled labor that Americans can and will supply.

Other fruits of great commercial value flourish in Cuba like the proverbial green bay tree. Lemon trees reach a superb size there, and the fruits are equal to the famous imported La France lemon of the Mediterranean shores. But no effort has been made to raise lemon groves systematically. Cocoanuts are native products of the island, and they thrive without apparent effort in the rich soil. The grape fruit, shaddock, lime, and similar semi-tropical fruits, which have obtained a small foothold in Florida, grow wild in Cuba. Many little known fruits, such as the guavas, sapotas, sapodillas, and kumquarts, are commonly found in all parts of the island. Many of these have peculiar flavors, and it requires a residence in the island to make one acquire a taste for them. On the other hand, there are many tropical fruits raised in Cuba that only need to be tasted by Americans to be appreciated. These can be cultivated with every prospect of success.

But if fruits are important products of the Cuban soil, what must one say of the vegetables? These grow and yield crops about every month in the year. Tomatoes are as plentiful as sands on the seashore. Vines never cease to produce fine tomatoes. In midwinter it is possible to purchase in Cuba corn, celery, lettuce, tomatoes, and artichokes cheaper than in our American cities in midsummer. The plants simply revel in the warm, moist climate.

Winter market gardening must, therefore, figure prominently in the future Cuban industries. Good market land is cheap and plentiful. With ten to twenty acres, an enterprising American farmer could raise all the vegetables he could use, and ship enough to the United States to pay him a moderate income. The truck gardening of Cuba has been even less developed than its fruit industries. The vegetables need not come in competition with those from our Southern States, for the time of shipping them north would naturally be in the early part of our winter. Then consignments of fresh vegetables direct from Cuba, in fast steamers, would find ready purchasers in many of our principal cities. We may soon expect to have watermelons in March and April, green pease in December and January, and tomatoes all the year round.

Market gardening in Cuba would be the easiest sort of work that a farmer could undertake. With considerably less cultivation than we give to our gardens and farms in the United States, fruits and vegetables produce remarkable crops, and, without fertilizers, the same land continues to raise plants and their fruits with prodigal luxuriance.

Onions and potatoes raised in Cuba are equal to any imported from Bermuda, and they could be shipped to the United States at less cost than from the latter place. In a very few years American brains and industry could monopolize most of the trade in tropical fruits and winter vegetables, which is now controlled largely by alien West Indian planters.

The effect that all of this development of latent Cuban industries would have upon our coast trade can readily be imagined. Already several new steamship lines are in the course of preparation for what is expected to be an active trade with Cuba when the war ends. It is the opinion of shippers that the trade with the island, when once begun, will develop quickly, and new industries will spring up with such marvelous rapidity that the "booming" of our own Western States in the past will be completely cast into the shade.

Besides the fruit industry, it is expected that Cuban mines will show unusual resources, and that much of our machinery will be needed to develop these. Iron ore is so plentiful in various parts of the island that American steel manufacturers have established mills there in the past, and one American firm has nearly $3,000,000 invested in iron mines near Santiago. The copper mines of Cuba are also known to be rich, but the real extent of their contents is not definitely realized. In the great mountain chains that rib the center of the island gold and silver have also been discovered, but so far no mining for the precious metals has been attempted. Under the Spanish rule the mineral resources of Cuba have never been thoroughly examined, and no one has ever attempted to mine systematically for such products.

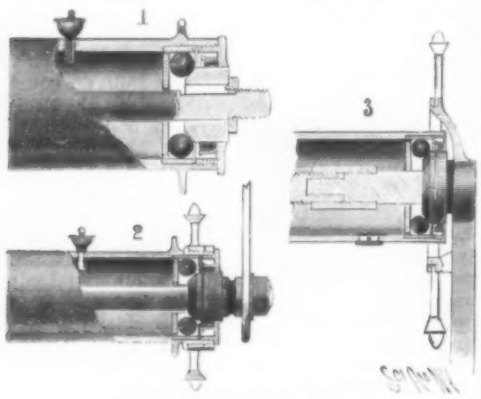
Thus, the outlook for hardheaded capitalists and energetic business men from the United States is promising in Cuba, whether the United States extends a protectorate over the island or merely shows a fatherly interest in helping the home government to maintain peace and order. All that is required for Americans to develop the industries of the island is a stable government, which will guarantee to protect their rights and make a peaceful existence on the island certain.

G. E. W.

AN IMPROVED BALL-BEARING.

The ball-bearing illustrated in the accompanying engraving is designed always to run true and to permit ready access to the various parts. Means are provided for lubricating the bearing and for excluding dust.

Of our illustrations, Fig. 1 is a partial section through the hub of a bicycle-wheel showing the parts of the



HITCHCOCK'S BALL-BEARING.

bearing. Fig. 2 shows the bearing applied to the rear hub of a bicycle-wheel. Fig. 3 is a sectional view of the bearing applied to the crank-hanger of a bicycle. In all these applications the essential principle of the bearing has been retained with but few modifications.

The bearing is surrounded by a casing, in each end of which a back-plate is secured. Each back-plate has a marginal flange extending outward. To the end of the shaft passing through the casing, cones are secured, coacting with the back-plates to form raceways for the balls. Each cone is formed with a peripheral flange. Retaining-rings are provided, which bear against the flanges of the back-plates. Dust-caps are secured in the ends of the casing and are provided with flanges coacting with the cone-flanges, with the retaining-rings, and with washers on the cones, to exclude all dust. The cones are secured to the shaft, not by the ordinary method, but by means of a shouldered key placed in a groove on the shaft and threaded as far as the shoulder; when the cone and locking-nut are assembled on the axle, the nut will engage the threaded end of the key, holding it firmly in place as well as the cone itself. By providing the back-plates and retaining-rings with small apertures, the lubricating material coming from the oil-cup is permitted ready access to all the moving parts.

The bearing has been patented by the inventor, Mr. A. G. Hitchcock, of 409 Fort Street, Honolulu, Hawaiian Islands.

Luxurious Travel in Siberia.

The new Siberian train which was recently sent to St. Petersburg for the approval of M. Khilkov, Minister of Ways and Communications, returned August 3, after being personally inspected by the Czar. It left with over forty passengers, including several Englishmen, Americans, and Frenchmen. This is the second train specially built for the quick service on the great Siberian railway. It is an improvement upon the first specially built train, which was already a marvel to Russians.

The new train consists of five coaches, two for second-class and one for first-class passengers, the others being a dining and a baggage car. The construction is of the newest design, and the train runs with great smoothness. Besides the comforts of a bath-room with gymnastic apparatus, a library in several languages, a piano and selection of music, maps, guide-books, albums of views, an ice-cellar, and an arrangement for boiling water in three minutes by means of steam, which were found in the first train, the new one is fitted with plates which indicate the next stopping station, and, if the stoppage be over five minutes, also how long the train stops.

All the windows are protected from dust and wind by external plate-glass guards; the last coach is arranged to serve as an "observation-car," showing three views of the country traversed. A stationary bicycle, with arrangements for measuring in minutes and kilometers the amount of work done, a barber, who is also qualified to give medical assistance, and a superintendent, who speaks Russian, French, German, and English, are among the other conveniences to comfort of traveling now provided. The train will be lighted inside and out by electricity, and electric cigar-lighters find a place in the dining-car. A lavatory has been fitted in the second-class car, so as to be available for the enthusiastic photographer to change plates and develop in during the journey. Electric bells and portable electric reading-lamps are in each compartment. The kitchen is intended to furnish a hot dinner for a maximum of sixty people. Paper and envelops are to be supplied gratis at the buffet, where hot and cold drinks of all kinds are to be had; there is no charge for the barber, but two rubles is the price of a bath, for which three hours' notice beforehand must be given.

From Moscow one may now get to within a few hundred miles of Irkutsk on the sixth day, and the charges for this journey under such luxurious circumstances are very moderate. The Englishman who cares to undertake the journey has only to see that his passport has been properly visèd in London before leaving; and even if he be entirely ignorant of any language but his own, he will find no difficulty in reaching the heart of Siberia by rail. In all the chief towns, as far as Irkutsk, one or two resident English or Americans are to be found, and they gladly welcome a fellow-countryman who brings the latest gossip from town. The French are already showing their appreciation of the opportunities offered for investigating the resources of Siberia. A special train from Paris is to leave Moscow for this trip in August, the whole time to be occupied being about one month.

What is Thought of it in California.

The Signs of the Times, published at Oakland, California, is an admirer of the SCIENTIFIC AMERICAN, and as it comes to us each week, says the editor, it is filled with most useful and practical matter. It keeps close watch of every field of science and industry and is a faithful recorder of the progress that is being made. It employs none but the most thoroughly competent writers, and consequently its information is always reliable.

It is a paper for men, and at the same time it is pre-eminently the paper for boys. Its matter has the advantage of being solid and substantial, while it is also most interesting as well. Boys will pore over its pages by the hour. And when they turn away from its study, their minds are filled with useful facts about farming, fruit-raising, carpentering, machinery, etc. For there is no field of the useful vocations of life from which this valuable paper does not bring you interesting sheaves of desirable knowledge.

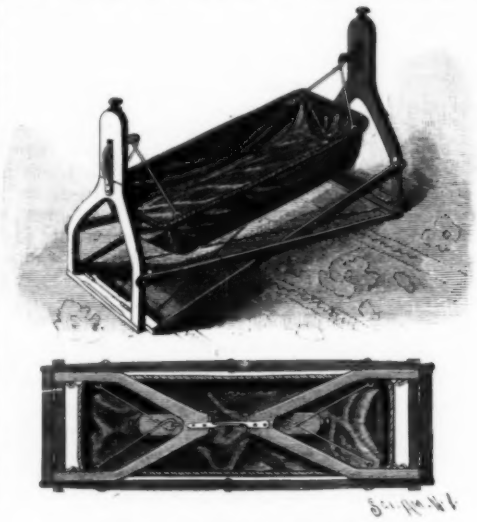
If parents will furnish themselves and their children with such papers as the SCIENTIFIC AMERICAN, instead of those that are more or less filled with stories of highway robberies, conflicts with policemen, hair-breadth escapes from bears and the like, they will see their sons grow into useful men rather than "border ruffians."

TASMANIA has one of the most wonderful tin mines in the world, called the Mount Bischoff Mine.

A FOLDING CRADLE.

An invention has recently been patented by Ralph Bird, of 307 Webster Avenue, Jersey City, N. J., which provides a novel cradle so constructed that it may be readily folded into compact form when not in use, thus permitting it to be stored and transported with great facility. The cradle, as seen from the engraving, has head and foot arches standing upon base-rails. On each base-rail a bar is hinged. Rods are connected with the bars and are provided with retractile springs by means of which proper tension is maintained. To each bar two braces are attached having slotted ends in which pins on the head and foot arches slide. Dogs are mounted in the slots and are capable of engaging the pins to hold the arches in vertical position. Each arch carries an extension-standard in which is mounted a bolt engaged by a keeper attached to the standard. By means of this arrangement the standards are held in raised position above the arches. The cradle itself is suspended by means of slings attached to the arches.

When it is desired to fold the cradle, the bolts in the standards are lifted out of engagement with their

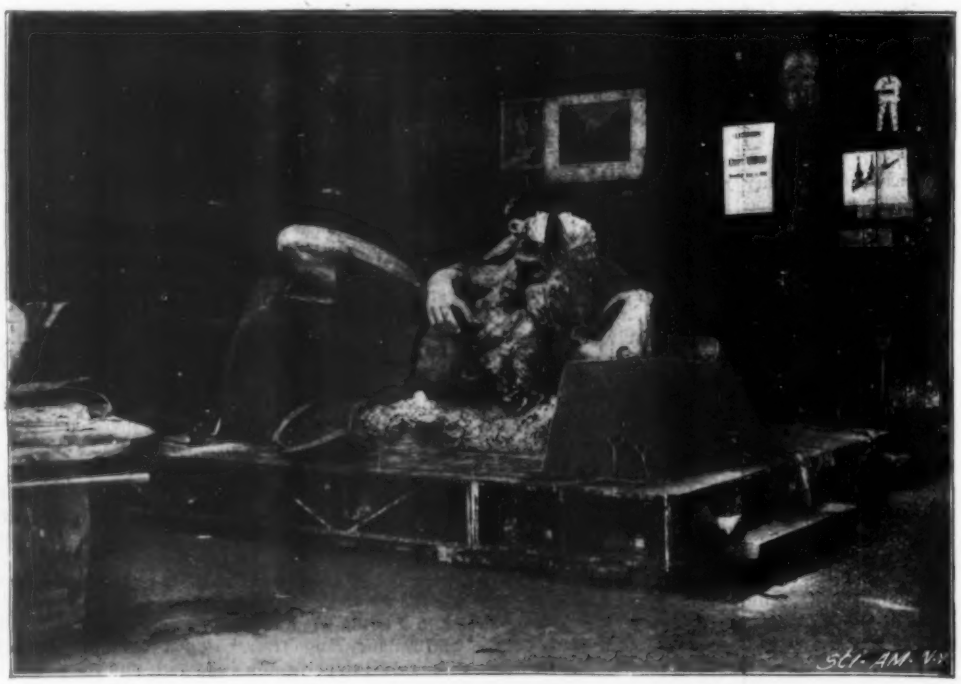


BIRD'S FOLDING CRADLE.

keepers and the standards are moved inwardly and downwardly. The dogs in the slots of the braces are then disengaged from the pins working in the slots; the arches are then folded down over the body of the cradle. The cradle itself, being made of fabric, readily collapses on the rods, and the whole device then appears as shown in the lower portion of our engraving.

A PHENOMENAL PIECE OF BRONZE CASTING.

No substance is so well fitted for monumental use as bronze. There is a sense of dignity, weight, and value about it when used in large masses which is possessed by no other material. It successfully defies the ravages of time, and its intrinsic value has not been found great enough to make it very often the prey of the vandal; so that, if it is surpassed in some of its properties by gold, silver, and platinum, the value of these precious metals has in itself invited the destruction of beautiful works of art. We have, however, a large number of bronze statues which have descended to us from antiquity which are to-day a striking example of the difficulties with which the early sculptors had to contend and the triumphs which the bronze caster achieved. By the nature of the material, everything which is possible to the sculptor's art is possible to bronze. It can be fused and cast into moulds of the most intricate shape, and it is interesting to note that the history of this alloy has no beginning, and we only know, on the authority of Sir John Evans, that our bronze age ceased in the fourth or fifth century B. C. We also know it immeasurably antedates alike history and tradition. Bronze working as a fine art is equally lost in the remoteness of antiquity, and from that time to the present day the art of the bronze founder has never been extinct.



THE MOULDING OF "PAN"—TAKING OFF PIECES FOR MAKING PIECE MOULDS ON LARGE PIECE.

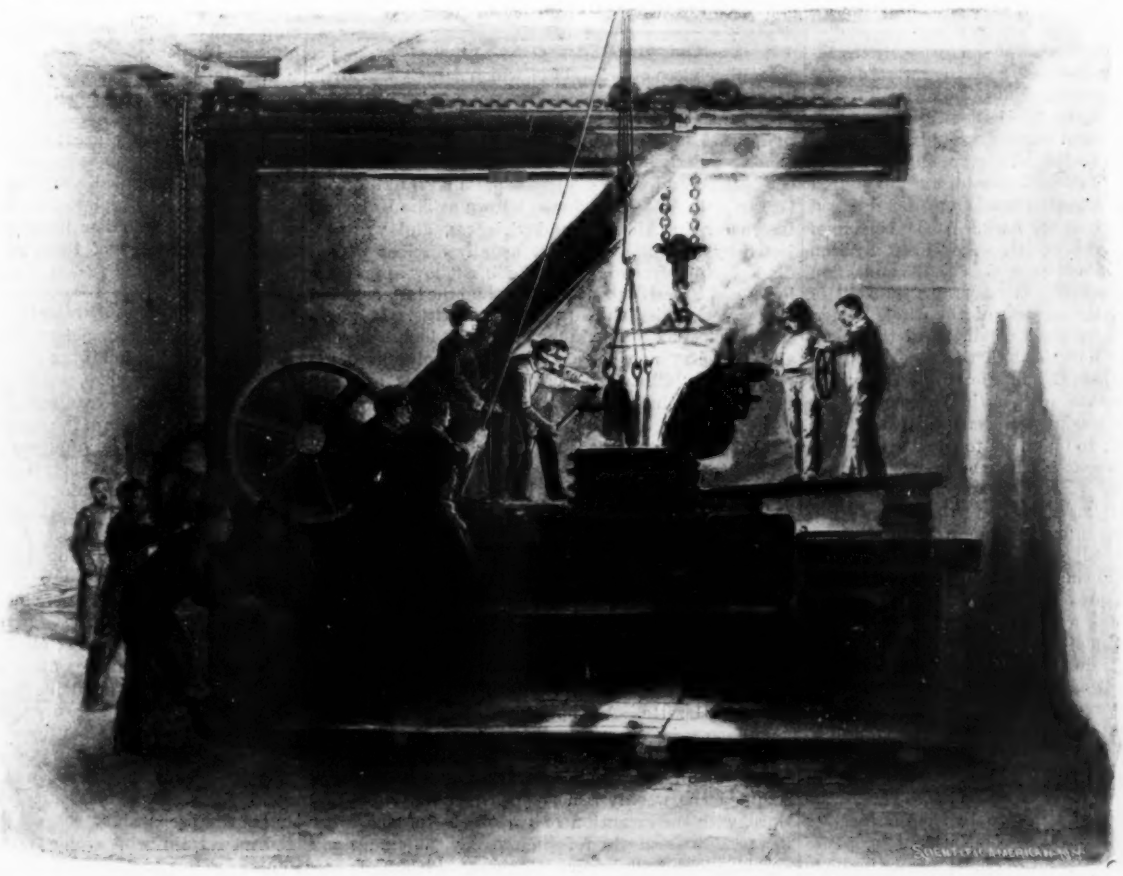
Until a few years ago, when it was necessary to cast a large statue or monument, we had to send to Munich, Berlin, Paris, or Rome to have the model executed in bronze, but it may now be said that the industry has become thoroughly naturalized in the United States. Splendid examples of the bronze founder's art are now executed here, castings in which technical skill and artistic feeling are combined with strict fidelity to the sculptor's models. Indeed, it seems as though some of our native American ingenuity has been grafted onto the magnificent technique of the foreign workman. Our illustrations present a notable triumph of this industry. They represent the moulding and casting of Mr. George Gray Barnard's statue of "Pan," intended for Central Park, where it will be placed on a natural bowlder in the lake opposite Seventy-second Street. The most interesting feature of this work is the fact that it was cast in one piece. This is the largest casting in bronze which has ever taken place in the United States, and was accomplished by the Henry-Bonnard Bronze Company, in New York city. This casting is by all odds the most difficult piece of work ever attempted in this country, and it is very doubtful if there is a bronze foundry in Europe which would care to risk the casting of such an artistic piece of work in one piece.

PART OF MOULD AND CORE SHOWING SPACE OCCUPIED BY THE METAL.

Before describing the casting it would be perhaps well to glance for a moment at the technique of the art. Before a work can be cast in bronze, it must, of course, exist in some other material. The sculptor usually makes a sketch of his idea, not on paper, but in wax or clay. This sketch is usually roughly modeled and is but a few inches high, so that it does not require any internal framing to support it. The general arrangement of the composition having been decided upon, the next step is the construction of a full-sized skeleton of iron, without which the statue in such plastic materials as clay or wax could not stand, but would soon yield to its own weight and sink to the floor. The iron frame or skeleton is made so substantial that the sculptor may have his work in the studio for several years without fear of its becoming injured. The model in clay is, of course, very tender, as the particles are not very tightly bonded together, and it therefore becomes necessary to have a plaster model, which is not so liable to be injured as the clay one, and it is this plaster model which is given to the bronze founder. In brief, the casting involves several operations—the construction of the mould, the preparation of the fluid alloy, the casting, the solidification in the mould and the subsequent liberation of the cast from the mould, and, finally, after all the gates are cut off, blemishes are removed and the various parts of the work are fastened together and the line of demarkation between the different pieces eliminated, the statue may be colored and then it is ready for erection.

The artist produces his statue without any reference at all to its capacity for "drawing" from the mould, and the bronze founder has to adapt his work to the most exacting conditions of undercutting and complicated outlines. It is nothing unusual in casting a statue to have a thousand or more pieces in the mould, and in the statue of "Pan," the moulder, Jean Leroy, spent eight months, with several assistants, in making the moulds for the huge god, and there were 1,700 pieces at least in the mould. One of our engravings shows the casting of "Pan," and another, part of the mould resting on the clay model.

When the plaster model was brought to the bronze foundry, it was laid on the bottom of a flask of great size, and loosely tamped in with a special sand used by bronze founders, which comes from Fontenay-aux-Roses, about sixteen miles from Paris. The figure being only half embedded in this sand, the surface of it was carefully pressed and smoothed all around the model, so that the latter presented somewhat the appearance of a bas-relief. The sand background was then dusted over with lycopodium, which takes the place of parting sand in the ordinary iron foundry. The object of this is to prevent one portion of the mould from adhering to another. The moulder then proceeded to work on the projecting portion of the model, making separate pieces, so that they can be withdrawn and replaced at will. The pieces were eight or nine inches thick and were generally wedge shape, in order that they might fit closely. Channels and indentations were formed in each piece in order to insure their assuming the same relative positions, and it is no easy task to remember where the small pieces go. In work of no great size, some of the pieces of the mould which is to receive the metal are no bigger than a pea. Sixteen pieces are often needed for an eye. All must be fitted with the greatest nicety. An immense amount of wire and iron clamps are embedded in the pieces of the mould to give them strength. After the various parts of the flask, each containing a large number of the pieces of the mould, were finished, they were removed and carefully dried and stored away in order to allow the moulder to work on other parts of the statue. After the entire work has been moulded, the bronze might be poured into it; but this would give a solid statue of enormous weight which would be heavy, expensive, and no better than a hollow statue, in fact, not as good, as the shrinkage would be increased, therefore the mould is "cored." The parts are assembled, and the core is made by filling the cavity of the mould with the same sand as before, only a softer variety is used, so that the figure is again reproduced. As, however, this sand figure occupies the entire cavity of the mould, it must be cut down, so that a space may remain between its surface and the interior of the mould, and this space will be filled by the metal. Our engraving shows the appearance of the core and the part of the mould, and also shows by a dark line the space which the metal was to occupy. Of course, such a core must be supported by an internal iron carcass, the ends of which project through various openings in the mould, serving to keep it in place. Without this it would fall, and thus prevent either the flow of the metal or would reduce the metal to a dangerous thinness. When the statue has been entirely moulded, the pieces of the mould are separated and dried in special ovens or furnaces. This operation takes place before the core is formed. The core itself must also be baked. The mould must be provided with openings for the admission of the metal and for the escape of the air and gas, and this result is obtained by the use of many gates and channels. After the core was put in position and all the pieces of the mould adjusted with care and accuracy, they were secured in place by a most elaborate system of clamps and iron rods. The mould in the bronze foundry weighed 54,650 pounds or about 27 tons. Some



CASTING THE STATUE OF "PAN" IN ONE PIECE—POURING THE BRONZE IN THE RESERVOIR.

idea of the great weight which had to be supported by artificial means will be gained when it is stated that the mould comprised some pieces which weighed from 4 to 5 tons each, and the core comprised 28 detached parts, besides the main core, which alone weighed 6 tons. The figure of "Pan" is 11 feet 4 inches long and 5 feet 3 inches wide. If the figure should rise, it would be 13 feet 6 inches high.

At this point it might be well to mention some of the difficulties which deter sculptors and bronze founders from casting large works in one piece. A bronze casting, unless it be of very small size, is always cast hollow, and in order that it may be so cast it is necessary that it should have a core inside as well as a mould outside. Now it is clear that if an object like a horse is to be cast with a core inside, and if it is to be cast all in one piece, the core will have to be left inside, since there would be no opening whereby it can be removed. Now the great weight of the core inside is a marked disadvantage in erecting or moving a statue, besides it puts an unnecessary strain on the legs of the horse. In addition, the material of which the core is composed is excessively porous, taking up moisture from the air, so there is a source of danger to the bronze statue, which is very likely not to be absolutely air and damp proof. There will be here and there some tiny flaw through which core will absorb air and will become so moist that a severe frost might swell it almost to bursting. But if the horse is cast without its head or neck, the core is usually removed and these dangers are avoided. To avoid these dangers, the ancients cast very large works in pieces, and modern founders find it advisable to cast their works in comparatively small pieces. There is another point which is an important one. If there should be any flaw in the mould or in the casting, the entire work of the moulders for months would be vitiated and they would have to begin anew. For this reason it is very rare to cast large works in one piece, and the great success which attended the casting of "Pan" at the Henry-Bonnard foundry is a triumph for art metal work in America.

After the various clamps and stays which held the model together were in place, the interstices were filled with sand, for cooling must be rapid to prevent the separation of the tin and copper which sometimes occurs, owing to the difference in their melting points. The sand was then tamped hard and the top and sides of the flask are applied.

The alloy used was 90 per cent copper, 8 per cent tin, 2 per cent zinc. The total amount of bronze melted was 6,450 pounds. It was melted in 15 crucibles, in 7 crucibles of 750 pounds and 8 crucibles of 150 pounds each. The fires were started at 1 A. M. August 22, and the casting took place at 5 P. M. the same day in the presence of a number of invited guests. The large ladle was heated, and when the bronze was at the proper condition of fluidity, the covers of the furnace were removed, the crucibles loosened, and they were drawn out with the aid of a tackle. They were carried to the ladle and emptied. When the ladle was full, it was hoisted by the crane and swung around in position over the flask, which rested in the casting pit. The scene was a magnificent one. The metal was not poured directly from the ladle into the mould, but was received in a reservoir at the top of the flask. At the bottom of the reservoir were holes, which were closed by iron plugs. When these plugs were closed, all connection with the gates was shut off. It was now a moment of great excitement, for the success of the whole undertaking depends upon the exact condition of the metal when it is allowed to flow through the gates into the space between the mould and the core. Every one waited with bated breath until, in the judgment of the foreman, the bronze was at the exact temperature to insure a perfect flow; too high or too low a temperature would ruin the casting. The men took the keenest interest and pride in their work, and waited like soldiers to receive and implicitly obey the orders given them. At the proper moment the foreman, Eugene Veillard, gave the word, and the plugs were removed from the reservoir and the metal flowed to all parts of the mould. Flames burst from all sides of it for a moment, and the foreman waved the American flag over this great triumph of metallurgical art in America.

The work of taking down the flask was soon begun, and the greatest possible care was taken to avoid injuring the statue, in removing the carcass which sustained the mould and the core. The cast was found to be smooth and perfect.

Artistically, "Pan" will be very interesting when placed on the big bowlder in the lake. The statue was offered to the city a year ago by the Clark estate and the model was approved by the National Sculpture Society. The measurements of the huge figure have already been given. The god is reclining on a ledge; one knee is raised, and one arm serves as a support. The repose is a lazy, careless one and he is blowing the "Pan" pipes. His long beard falls over his breast; his hair tumbles carelessly over his head. The head differs somewhat from the Greek conception of the god, but it is thoroughly artistic and will prove an excellent addition to the sculpture of Central Park which is already too much burdened with solemn rows of bronze statues of the departed great.

Prof. Haeckel on Evolution.

At the Cambridge Congress of Zoology Prof. Haeckel read a fascinating paper on the descent of man. He does not hesitate to say that science has now definitely established the certainty that man has descended through various stages of evolution from the lowest form of animal life, during a period of a thousand million years. The New York Sun with commendable enterprise cabled over quite a full account of the paper, and goes on to say: Lamarck, Darwin, and finally scores of other investigators won the knowledge which must now be accepted as the crowning achievement of science during the nineteenth century.

Recent discoveries of fossil remains in Java, Madagascar, and Australia have made still more complete the evidence, available proof, and discoveries wherewith Darwin's name is most commonly associated. Prof. Haeckel thus summarized the steps in evolution:

"The monophyletic origin of all mammalia—that is to say, their origin from one common parent form, from monotremata upward to man—is no longer a vague hypothesis, but an established fact. All the living and extinct mammalia which we know are descended from a single common ancestral form which lived in the Triassic or Permian period, and this form must be derived from some Permian or perhaps Carboniferous reptile allied to the Progonosauria and Theriodontia, which was derived from a Carboniferous amphibian of the group Stegocephala. These amphibians in turn descend from Devonian fishes, and these again from lower vertebrates. The most important fact is that man is a primate, and that all primates—lemurs, monkeys, anthropoid apes, and man—descended from one common stem. Looking forward to the twentieth century, I am convinced it will universally accept our theory of descent. I have no doubt that the strong influence of anthropogeny upon other branches of science will be most fruitful."

A member of the congress said that Prof. Haeckel had spoken of one thousand million years as necessary for his evolution tree, while Lord Kelvin supposed himself to have proved that this world as the scene of life could not be more than twenty-five million years old. It seemed unwise to complicate Prof. Haeckel's theory by assuming that a thousand million years would be required for proof.

Prof. Haeckel replied that the computation was not his own. He took the time from one of the most eminent geologists. For himself he confessed that he had no intuition as to the length of time required for the evolution.

The congress received and discussed Prof. Haeckel's paper with the greatest enthusiasm.

The Oldest American Journal.

Another piece of bric-a-brac which Mr. Cyrus Curtis has coveted for many years, but was not able to purchase until recently, is The Saturday Evening Post, the oldest newspaper in America, which has been issued regularly in the city of Philadelphia since December 24, 1728, and was edited by Benjamin Franklin from 1729 to 1765. It was originally known as The Universal Instructor in All Arts and Sciences, and was projected by Franklin, but that usually discreet person disclosed his plans to George Webb, a fellow-apprentice in Samuel Kiemer's printing office, and the latter started the paper under that preposterous title. It was a small folio, six and a quarter by ten inches in size, and the first number contained two columns of reprint from "Chambers' Dictionary of Arts and Sciences," which had recently appeared in London, three advertisements, and a grandiloquent address from the publishers, who promised that "each person who preserves their papers will possess the richest mine of knowledge (of the kind ever before discovered, except of late in Europe)."

Franklin was naturally indignant at having his ideas stolen, but, after thirty-nine numbers had been published, Kiemer was glad to unload the enterprise, and the paper was purchased by Franklin and Hugh Meredith for a trifling sum. Kiemer claimed a circulation of 250 copies, but Franklin asserted that it had but ninety paying subscribers. The new proprietors dropped the absurd title and called it The Pennsylvania Gazette. At that time there were only five newspapers in America, all weeklies. A year later Franklin made it a semi-weekly, the first in America, but it did not pay, and, after two brief experiments, resumed the weekly issue, which has continued ever since, with the exception of two weeks in 1765, when it was suppressed for refusing to pay the stamp tax, and large handbills headed "Remarkable Occurrences" were published instead, and during the occupation of Philadelphia by the British from November 27, 1776, to February 5, 1777, and from September 10, 1777, to January 5, 1779. In these periods a few straggling numbers were printed at York. When the regular publication was resumed upon the evacuation of the city, the title was changed to The Pennsylvania Gazette and Weekly Advertiser. David Hall purchased the property in 1776 and his sons ran the paper, with the assistance of several partners, until 1821, when it passed into the hands of one Atkinson, who changed the name to The Saturday Evening Post, as it has since been known.

For half a century it has been published in the same old-fashioned way, for the benefit of the same old-fashioned, conservative patrons and their children and grandchildren, with a highly moral serial story, a column or two of antique and shelf-worn anecdotes, selected poetry, conservative comments upon current events, crochet patterns, charades and rebuses, a column of "wit and humor" and a page of Sunday reading. With the aid of a pair of scissors and a pastepot one man has been able to do all the editorial work, and another has attended to the business department.

Bids for Three Eighteen-Knot Battleships.

The bids which have been put in for the construction of the three new battleships which are authorized for the navy make it certain that the vessels will be of at least 18 knots speed, as against the 15 knots speed which was the minimum that had been previously imposed by the government.

The successful bidders are the three well known firms, William Cramp & Sons, of Philadelphia, the Newport News Company, of Norfolk, Va., and the Union Iron Works, of San Francisco, the builder of the "Oregon."

The bids were as follows: Newport News Company, one ship, class 1, in 31 months, for $2,581,000; one ship, class 2, in 32 months, for $2,680,000, minimum speed, 17 knots; one ship, class 2, in 32 months, of 12,500 tons, 18 knots minimum speed, for $2,850,000.

William Cramp & Sons, Philadelphia, one ship, class 1, in 29 months, for $2,650,000; two ships for $2,625,000 each. One ship, class 2, of 11,500 tons, 17 knots, in 32 months, for $2,725,000; two such vessels for $2,700,000 each. One ship, class 2, of 12,150 tons, 18 knots, in 32 months, for $2,885,000, and two such ships for $2,870,000 each.

Union Iron Works, San Francisco, one ship, class 1, for $2,674,000, in 31 months; class 2, one ship for $2,725,000, 17 knots; class 2, one ship in 33 months, 12,200 tons, 18 knots, for $2,899,000.

It is expected that the Cramps will build a practical duplicate of the Russian battleship which they have in hand. This vessel is to be 376 feet long, 72 feet wide, 26 feet draught, and of 12,700 tons displacement, with a coal capacity of 2,000 tons. She is to maintain an average speed of 18 knots for 12 hours. This is 8 hours longer than the term required by the United States.

The 18-knot vessel proposed by the Newport News Company is based upon the department plan, the increased displacement being secured by lengthening the ship by 15 or 20 feet and putting in more powerful engines and boilers.

The Union Iron Works also propose to lengthen the hull and put in additional boilers of the water tube type.

There is cause for great satisfaction in the change that has thus been made in the designs of these vessels. As originally proposed, they would have been so slow as to be almost obsolete for their purpose; but the new vessels, if a similar improvement is made in the velocity and energy of their armament, will be thoroughly up to date.

Yale's Physical Statistics.

Dr. J. W. Seaver, associate director of the Yale gymnasium, gives the following physical measurements of the Yale freshman class, whose compulsory gymnastic work was begun this year, says The New York Evening Post. The average age of the class at the time of measurement was found to be nineteen years one-half month. The oldest man in this class was thirty-three years and youngest fifteen years nine months. Average height, 5 feet 7·5 inches. Tallest member of the class, 6 feet 3½ inches, shortest 5 feet ⅞ inches. The average weight, 134·2 pounds, the heaviest man being 215 pounds and the lightest 101½ pounds; girth of chest, normal, 34·4 inches; girth of chest, inflated, 35·8 inches; girth of biceps, 11·5 inches; girth of neck 13·8 inches; girth of head, 22·4 inches; girth of waist, 28·1 inches; girth of thigh, 19·9 inches, and girth of calf, 13·7 inches; capacity of lungs, 4 cubic liters, or 240 cubic inches.

Comparing these measurements with those of the freshman class at Yale fifteen years ago, Dr. Seaver finds the average freshman strong physically at almost every point, his lung capacity having risen from 225 to 240 cubic inches. This is attributed to athletic training in the preparatory schools, where Dr. Seaver says ten men train where one trained fifteen years ago. There are but ninety-seven men, or 38 per cent, of the freshman class who have normal eyes. Seventeen others have one normal eye, the other eye being abnormal to the extent of at least twenty-thirtieths. Thirty-eight men, or about 13 per cent, used glasses before entering college. No figures are obtainable for discovering whether there are fewer men with normal eyes now than ten years ago, but it is believed that this is the case.

Miscellaneous Notes and Receipts.

Glossy Blacking for Shoes consists of the following ingredients, according to Neueste Erfindungen und Erfahrungen: Spirit, 126 parts; camphor, 11 parts; Venetian turpentine, 16 parts; shellac, 36 parts. Color with 32 parts of a mixture composed of aniline blue, 15 parts; Bismarck brown (phenylene brown), 15 parts; and spirit, 800 parts.

To Give Zithers a Soft, Full Tone.—The purpose of an invention which has lately been patented in England is to impart a soft, full tone to zithers, which is purported to be attained by the use of glass rods as frets for these musical instruments. These glass rods may possess any desired thickness, and the strings are stretched over them in the usual manner. The musical effect attained with such a zither is said to be quite astonishing.—Neueste Erfindungen und Erfahrungen.

Artificial and Natural Indigoes.—Leon Lefévre reports the experiments of a dyeing establishment in France which tested the artificial indigo alongside of the natural product, in exact comparison, on hank. According to the results obtained, artificial indigo would be about 5 per cent cheaper, on the basis of the 1897 indigo prices, while with the present low price of the natural product the same comes 5 per cent higher. As regards the quality of fastness, both are equal.—Revue Générale des Matières Colorantes, 1898, 226.

Varnish and Linseed Oil.—At the occasion of a dispute, O. Bach has conducted experiments to determine the non-saponifiable parts in a number of differently produced linseed oils of authentic purity. He found in cold-drawn linseed oil 0·42 per cent; warm-drawn oil, 0·32 to 0·92 per cent; extract oil, 0·61 to 0·90 per cent; Baltic oil (nine years old), 0·88 per cent; boiled varnish, 0·43 to 0·74 per cent; varnish prepared in the cold, 0·95 to 1·71 per cent; "stand" oil, 1·0 per cent. From this he forms the conclusion that in varnish (even that prepared in the cold, i. e., by adding resinates) the percentage of unsaponifiable substance should never be higher than 2 per cent at most.—Zeitschrift oeffentl. Chemie, 1898, 167.

"Colored Colors."—The denomination of "colored colors" may sound paradoxical, but as a matter of fact mineral colors are frequently met with of late whose dull and little productive character is rendered more fiery and richer by an addition of coal-tar colors. In general, no objection can be made to such a procedure, if colors sufficiently fast to light are chosen, as is well possible nowadays. But very often this is not done. Thus the eosines used for carminette are very fugitive; likewise coloring with fuchsine and aniline blue fades in the light. If one wants to employ artificial organic coloring matters for fining, faster ones should be employed. According to M. Bottler, the rather fast rhodamines, next methylene blue and meldola blue, which are very fast, deserve a preference. Against the use of ponceau, coccines, and scarlets, which for the most part are not inferior as regards fastness, to the cochineals, whose place they have taken, less objection can be raised. Since it has been established by the above mentioned observations that for coloring various varieties of carminette, velvet red, purple, cinnabar red (vermilion), and chrome red such artificial organic coloring matters are also employed as are liable to fade quickly, this fact should be given sufficient attention in practice. Carminette is frequently used, prepared with turpentine and English varnish, as a carriage color; likewise vermilion and chrome red.—Maler Zeitung.

Varnish for Photographs.—Varnishes for photographic negatives have to meet very special requirements. They must be colorless, hard, impervious, but at the same time elastic and exceedingly adhesive. If they are not hard enough, the plate is injured in printing the positive copies; if the elasticity is lacking, the negative will easily tear and crack. Another important requirement is exacted from the photograph lacquer: with hardness, elasticity, and viscosity, it must dry so quickly that the plate can be retouched immediately after varnishing. Following are some recipes for photograph varnishes (by weight throughout): 1. Sandarac, 16; lavender oil, 12; chloroform, 2; rectified alcohol, 90. Filter off all insoluble parts. 2. Place shellac in a concentrated solution of ammonium carbonate, extract the latter, and substitute pure water (shellac, 1 part; water, 8 parts), whereupon the shellac dissolves. 3. Take shellac, 2; sandarac, 12; mastic, 12; ether, 150. Dissolve entirely and add benzole, 9. 4. Digest dammar, 2, with acetone, 9, in a well-closed flask for two weeks in a warm place, shaking from time to time. Then pour off from the insoluble residue. Several coatings are required of this lacquer, which is also adapted for paper. 5. Gum lac, 75; sandarac, 10; alcohol (95 per cent), 915. 6. Amber, 2; copal, 2; benzole, 4; rectified alcohol, 30. 7. Amber, 4; copal, 4; mastic, 2; petroleum ether, 20; rectified spirit of wine, 40. 8. Sandarac, 40; turpentine, 4; lavender oil, 5; ether, 5; absolute alcohol, 100. 9. Mastic, 2; turpentine, 2; bleached shellac, 10; rectified spirit, 60. Care should be taken to use only the purest ingredients obtainable.—Färben Zeitung.

Spiders and Pitcher Plants.

In the insectivorous plants of the genus Nepenthes, a form represented by a number of species and widely distributed over the Indian and Australian regions, as well as in Madagascar, the pitchers or insect-traps, which are usually regarded as expansions of the leaf-stalk, are suspended, mouth upward, at the ends of long tendrils proceeding from the tips of the leaves. The gaping orifice, frequently strengthened and kept open by a thickening of the rim, is protected by a lid, which, while preventing the infall of rain, offers no obstruction to the free entrance of insects. To attract the attention of these animals the pitchers are frequently conspicuously colored in their upper parts, and honey is secreted from glands scattered around the margin of the aperture and on the under-face of the lid. This gaudy and sweetened portion, designed as it is to catch the eye and act as a bait, constitutes the "attractive" area. A short distance within the cavity and below the attractive area just described, the walls of the pitcher are smooth and of a waxy consistency, so that no foothold is afforded to insects, which are consequently precipitated to the bottom of the pitfall if luckless or incautious enough to venture on this "conductive" area. The lower part of the receptacle is filled to a greater or less extent with a fluid, containing among other substances potassium chloride, malic and citric acids, as well as soda lime and magnesia in smaller quantities, and an enzyme which, in the presence of the acids, has the power of digesting organic matter. This fluid, poured out as a secretion from a large number of glands developed in the adjacent walls of the pitcher, is usually crowded with the indigestible remains of insects, commingled with those of which the nutritious tissues are in process of decomposition under the action of the alimentary juice of the plants and of the bacteria which infest it.

The spiders of the family Thomisidæ belong to that artificial section of the order sometimes spoken of comprehensively as the wandering or hunting species as opposed to those of sedentary habit, which spin snares for the capture of prey. Some of the Thomisidæ live on the ground among vegetable débris or beneath stones; others on the trunks or leaves of trees; others, again—and those are the species that have attracted the greatest amount of attention—frequent flowers, and lurk among the petals on the watch for visiting insects. To this last category belongs the spider (Misumena nepenthicola) now under discussion, a species which invariably takes up its abode in the pitcher of a North Bornean (Labuan) Nepenthes, perhaps referable to the species described as N. phyllamphora; in any case, whatever the name of the plant may be, the Misumena appears to inhabit exclusively the one species, for although several other kinds were found growing in the vicinity, they were never observed to be tenanted by spiders.

According to that skilled collector and trustworthy observer, Mr. A. Everett, who kindly furnished me with the notes forming the basis of the account here given, the pitchers in question are somewhat elongate in shape, and constricted a short distance below the rim, broadening out again as the bottom is approached, and narrowing ultimately to a vanishing point where they join the supporting stalk. Just below the upper constriction the spider spins a slight web, adherent to the wall of the pitcher. This web is not of the nature of a snare or net designed to intercept insects, but extends as a thin carpet over a small portion of the conductive area, and enables the spider to maintain a secure hold on its slippery surface. Here it lives and rears its young, no doubt feeding upon the insects which the Nepenthes attracts for its own use, capturing them either as they enter the pitcher, or perhaps after they have fallen in the digestive fluid below.

So far as procuring food is concerned, this spider would seem to be no better off than those of its allies which live in flowers and capture the honey-seeking insects that visit them, except in so far as it is not dependent upon seasonal inflorescence for a place wherein to lurk. But in one very important respect it must presumably score heavily in the struggle for existence—that is to say, in its means of escaping from enemies.

It is a well known fact that almost all spiders, especially those that occur in tropical and subtropical countries, suffer immense mortality from the relentless persecution of the solitary mason wasps, which at their breeding season scour the country and explore every nook and cranny in the eager search for spiders wherewith to lay up a sufficient store of food for the voracious young wasps during the days of their larval existence. From these enemies the flower-frequenting species have no means of escape, except such as is afforded by quiescence, in conjunction with the protective nature of their colors, attitudes, and form. The slightest movement on their part will attract the notice of the quick-sighted wasp, and bring swift destruction upon them.

Whether or not the mason wasps have the temerity to invade the pitchers of Nepenthes in their quest for victims, there is no evidence to show. Possibly long-billed birds thrust their beaks into the insect-trap to extract any living things or organic débris they may contain. At any rate, the account given by Mr. Everett of the behavior of this spider when threatened with danger points forcibly to the conclusion that the species is subject to persecution from enemies of some kind or other. This collector found that when an attempt was made to capture them by tearing open the pitcher, the spiders, although very active, never attempted to escape from the mouth of the vessel, but ran down its inner surface, and plunged boldly into the liquid at the bottom, ultimately, if still pursued, retreating to its very base, and burying themselves among the remains of ants, moths, beetles, etc., with which the pitcher was more or less choked.

Although many spiders of semi-aquatic habits, such as Dolomedes, Thalassius, and some species of Lycosidæ, plunge beneath the surface of water when threatened with danger, and escape along the stems of the subaqueous weeds; and although an example of Araneus (Epeira) cornutus, a terrestrial species, which, however, frequents the banks of streams and marshy country, has been noticed, when disturbed, to drop to the ground, run into the water, hide beneath a tuft of weed, and there remain for a minute or so before venturing to climb back to its web, I am not aware that the adoption of water as a city of refuge has ever been recorded of any member of the family Thomisidæ. These spiders, in fact, as already explained, depend for safety upon protective assimilation to their surroundings. Consequently, the habit of plunging into the fluid in the pitcher of Nepenthes, adopted by Misumena nepenthicola, must be regarded, it appears, as a new instinct acquired by the species in connection with the exceptional nature of its habitat; and its behavior carries with it the conviction that the species is constantly subject to persecution from some enemy other than man, whether it be bird or wasp.

Possibly the spiders, when once they have taken up their abode in the pitcher are, like the insects that venture in, unable to get out again on account of the opposition to exit offered by the slipperiness of the walls of the conductive area. If this be so, they would be compelled, in case of attack, to seek safety in the lower parts of the pitcher; and while those too timid to take the plunge, or too weak to withstand the immersion, would be captured or destroyed, their instinctively bolder or physically hardier companions would be saved to transmit their characteristics; and so by a process of elimination and selection the instinct would be gradually brought to the state of perfection Mr. Everett has described.

Lastly, if it be wondered by what means the spider is able to resist the action of the fluid, and to regain its position of security in the upper part of the pitcher, it must be remembered, in the first place, that a great many spiders, as well as many insects, can be immersed in water and other liquids and withdrawn in a perfectly dry state; and in the second place, that almost all spiders, when dropping from their webs or leaping after prey, insure a safe return to the spot they have left by letting out a drag-line of silk, which passes from the spinning mammillæ to the point of departure. A silken thread of this description would enable M. nepenthicola to climb out of the digestive fluid which retains the captured insects; while the nature of the integument and of its hairy clothing would prevent the penetration of the fluid during the short time that the spider remains beneath it.—R. I. Pocock, in Nature.

A Pygmy Locomotive.

What is claimed to be the smallest locomotive for drawing passenger cars has been built by T. E. McGarigle, of Niagara Falls, and the small steam road is to be operated at the Trans-Mississippi Exposition, in Omaha. In all, six locomotives are to be built. It is possible that they will be used also at summer resorts, such as Coney Island, Atlantic City, and other places. The road in Omaha is about 1,100 feet long. The locomotive from the point of the pilot to the rear of the tender is 7 feet 3 inches long, and it weighs about 600 pounds and can draw ten cars, each containing two persons, or a weight of about 4,000 pounds. From the top of the stack to the rail is 25 inches and the gage is 12½ inches. The steel boiler is tested to 300 pounds pressure and works at 125 pounds. The boiler is of 1½ horse power and it will hold 24 gallons of water. The feed water is supplied by two injectors and there is a steam brake between the drivers. The cylinders are 2 × 4 inches. The wheels of the forward truck are 5 inches in diameter. The tank in the tender holds 30 gallons of water, and the operator sits on the seat in the tender. The scale is about one-seventh of a full sized locomotive, and the type selected is one of the latest engines on the New York Central road.

RUSSIA is going to abolish the difficulties of navigation at the mouth of the Volga by cutting a canal directly from the river to the Caspian Sea. Work on it will begin this summer.

THE GOVERNMENT EXHIBIT AT THE TRANS-MISSISSIPPI AND INTERNATIONAL EXPOSITION.

It is admitted that the government of the United States is one of the most important factors in the Omaha Exposition. Its exhibit is not only unquestionably the best on the grounds, but it is the best selected collection of exhibit material and the best installed of any previous governmental exhibitions, not excepting that of Chicago. The reason for this is that only men of experience have been placed in charge of the work of accumulating the collections and installing them, and, through the experience acquired at many expositions, the work has been done in a most thorough and satisfactory manner.

Out of an appropriation of $200,000 made by Congress for this purpose, $62,500 was set aside for the building proper, which was constructed under the direction of the supervising architect's office of the Treasury Department.

The departments of the government represented are the State, Treasury, War, Navy, Post Office, Interior, Justice, and the Agricultural Departments, with the Smithsonian Institution and National Museum and the United States Fish Commission.

The building, which is the largest on the grounds, is 400 feet in length, 146 feet in width at the center, and 100 feet at the ends. One of the chief architectural features of the structure is the dome, the height of which is 185 feet to the torch held in the hand of the colossal figure of Liberty which surmounts it. The facade of the central portion of the building is 58 feet high and of the wings 43 feet. It is built of wood and iron, covered with staff, as were the Exposition buildings at Chicago.

Never before has the Government building at an exposition been so artistically and beautifully decorated, the color scheme and general details having been selected and arranged months before the beginning of the work of construction by a decoration committee made up of members of the board.

It would be impossible, in the limits of this article, to describe in detail even the main features of the exhibit material, but there are particular exhibits, however, which give character to the departmental spaces where installed, and as these are the first to impress themselves upon the great mass of visitors, who, as a rule, seek amusement rather than instruction, they deserve first mention.

THE LAGOON BY NIGHT—GOVERNMENT BUILDING IN DISTANCE.

Starting at the north entrance, west side, the visitor enters the spacious archway leading to the grotto of the Fish Commission. The exterior is of paneled woodwork finished in imitation ivory and gold. The interior is treated in imitation of a roughly blasted rock tunnel; numerous stalactites, glistening in a pale greenish hue, depend from the roof of the grotto. On either side are the aquaria tanks, richly decorated inside with sand, rock, and aquatic plants, and so arranged that all light entering the grotto passes through the water in the tanks and their plate glass fronts. In the two rotundas, rocky cascades are formed with large pools, illuminated by electric lights. All of the tanks and pools, with the exception of eight, are devoted to the display of fresh water fishes reared by the United States Fish Commission and the indigenous varieties of the Mississippi and Missouri River valleys. In the salt water aquarium are exhibited most of the important fishes of the New England coast.

Other features of the Fish Commission exhibit, and which are arranged outside of the grotto, are the extensive apparatus for collecting, dredging, and trawling, and for preserving collections; for deep sea soundings, transportation, fish hatching and rearing, with a large series of models of boats, vessels, buildings, etc., used in the work of the Commission. There is also a large and valuable museum collection of marine animals and fishes, both dry and alcoholic, the whole forming a most instructive and beautiful showing of the scientific and practical work of this important branch of governmental aid in the development of our national resources.

The next space is that of the Post Office Department, and, though the exhibit is smaller in size than that made at Chicago, it surpasses any previous attempt to illustrate this branch of the public service, which is so near to the people.

The stamp collection would set a philatelist wild with envy. It includes a complete series of United States postage stamps from their introduction in 1847, including department, special delivery, postage due, and newspaper and periodical stamps; also sets of stamped envelopes from 1853 (date of introduction) to date, and sets of foreign stamps, postal cards, and wrappers to 1898 from all stamp-issuing countries of the world.

In the Equipment Division there are models of the "Paris" and of smaller types of mail boats and of postal cars in use in this country, a full sized Western mail coach and models of foreign mail coaches, mountain mail courier, toboggan and dog outfit employed in snow-clad regions, together with life size figures of city mail carriers of the United States and other countries. The exhibit of the Dead Letter Office is particularly interesting, as it is made up of objects sent through the mails that have never reached their destination. In this incongruous collection will be found explosive bombs, deadly weapons, tarantulas, and rattlesnakes sent alive, and poisonous liquids and compounds, letters written on collars, cuffs, and boards; children's toys, Indian scalps, skulls, police billy, stuffed birds, etc.

There are voluminous postal records and a fine collection of portraits, engravings, and photographs. A branch post office is located near the space, where all the Exposition mail is handled.

The exhibit of the State Department and the Executive Mansion occupies the space directly in the center of the building, west side, and comprises forty-one exhibits, some of them being collective exhibits of great value. Naturally, the larger portion of this exhibit is in the form of books, printed and written documents, maps, photographs, etc., among which are letters and manuscripts of great historical interest and value, diplomatic papers bearing the signatures of kings, princes, and potentates. Among valuable manuscripts may be mentioned exhibit No. 22, the papers of Benjamin Franklin, arranged in fourteen large volumes, and exhibit No. 23, the papers of Thomas Jefferson, arranged in one hundred and thirty-five volumes.

The portrait collection is very interesting, containing the portraits of every President from Washington to McKinley, the portraits of the Secretaries of State, and many others, including old world rulers. Other exhibits illustrate the methods of transacting business in the various bureaus. The medal and coin collections are very valuable, and there are exhibits of articles of historical interest, such as swords, flags, etc.

The Treasury Department space is the first in the southwest section of the building after passing under the dome, and its display is particularly attractive. The exhibit of the Lighthouse Board is a source of wonder to the western rural visitor, who gazes curiously at the immense lenses of first and second order lighthouses. Near the model of a fog bell is a large model of Minot's Ledge light on the Massachusetts coast, illustrating the granite-built form of structure erected on sunken ledges. Models are also shown of the airy and graceful open-work form of iron structure, of which the Fowey Rocks light, on the Florida reefs, is an example. Everything connected with government lighthouses has a place in this exhibit, and a keeeper is on the ground to explain what is not understood.

The collection of coins includes a specimen of every coin struck by the government since its foundation; in fact, the financial branch of the department is illustrated by a complete exhibit of the currency issued by the government, from a ten cent piece to a ten thousand dollar gold note. The process of coining the money of the government is shown by the operation of a coin press which has been in use in the Philadelphia mint for upward of fifty years. It has a capacity of ninety thousand dollars per hour, and in coining silver dollars, strikes with a force equal to the weight of one hundred tons.

The Marine Hospital Service exhibit illustrates in a very complete manner the efforts of the government in preventing the introduction and spread of epidemic diseases. And in its entirety it embraces every branch of medical science, including the wonderful X ray apparatus, which, naturally, is one of the popular exhibits of the building.

The Life Saving Service is practically illustrated by a crew on the grounds, which gives an exhibition drill in the lagoon daily.

One of the most interesting exhibits in the space of the Agricultural Department is the practical demonstration of the inspection of pork as conducted by this bureau at various packing centers in the United States. Assistant microscopists are engaged in making examinations of pork samples, furnished daily by packing houses at South Omaha, Nebraska. The microscopes and other appliances are similar to those used elsewhere for this purpose. About 1½ per cent of the carcasses examined show trichinæ, so it is possible for the young lady attendant, in charge of the work, to give visitors an opportunity to see a bona fide example of trichinæ, by means of an extra microscope arranged for the use of the curious public on a table near. A large pathological collection of specimens in alcohol illustrates the many other diseases of animals, while there are models of sheep dipping vats, a collection of cultures of bacteria, etc. The Dairy Division of the department also makes an interesting showing, including a series illustrating the constituent parts of milk.

The Chemical Division illustrates the chemical side of the beet sugar industry, while the progress of entomological science is presented in the next space by interesting exhibits of insects and their work, with the insecticides for their destruction.

A collection of fruit models in wax, prepared by the Division of Pomology, is a very attractive feature.

The instrument tables in the Weather Bureau exhibit are constantly surrounded by inquiring visitors. One delicate instrument, partly the invention of Prof. Marvin, records on a strip of paper the direction and velocity of the wind, the variations in temperature, the duration of sunshine or cloudiness, with the amount of rainfall, when it does rain, during a given time. For

example, in a recent storm at Omaha a four-tenths fall of rain was recorded in 5 minutes, an inch in 30 minutes, and 2½ inches for the afternoon. Instruments arranged on the roof of the building are connected by wire with those upon the tables in the space, and the work goes on daily with only a simple winding of the clock mechanism and the changing of the record blanks once every 24 hours.

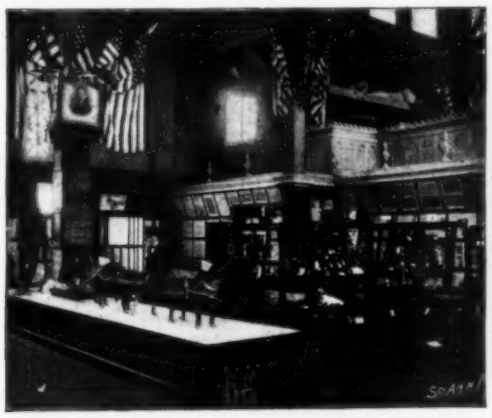
The Botanical Division confines its exhibit to a collection of poisonous plants and to illustrating the government methods of seed inspection. In the same alcove the division of Vegetable Physiology and Pathology has a most attractive exhibit of the wild and cultivated mushrooms of the United States, with a large model of a cellar for mushroom cultivation. Here the mushrooms are found "growing" (in wax) in all stages, and a pamphlet of instructions given out gratuitously tells the visitor how to do it himself if he wishes to embark in the enterprise.

In the Forestry Division space is shown a large series of woods. There are also three very instructive relief models of a farm, showing (1) the devastation consequent upon indiscriminate cutting and other destruction of farm forest cover; (2) the method of restoring the forest cover where needed, and recuperating the wasted soil; (3) rational utilization and proper disposition of the farm forest. An outdoor tree-planting exhibit completes the showing of this division.

A very attractive alcove is that devoted to the flax and hemp of the world prepared by the Office of Fiber Investigations. There are 22 panels measuring 2 × 5 feet, under plate glass, in which are arranged all the leading forms of the flax and hemp of commerce. The examples of flax grown in the United States include one sample, from a departmental experiment, that Irish spinners have valued at $500 per ton. This and other specimens near it show conclusively the value of the work done by the Office of Fiber Investigations, for they demonstrate the practicability of the culture in this country beyond question. A frame containing 18 reports published by the fiber office forms a part of the exhibit.

We have now reached the south end of the building, having reviewed all the exhibits between the main aisle and the west wall. Starting again at the southeast corner of the building, the visitor finds himself in the interesting space devoted to the War Department.

There is an interesting exhibit of small arms of historical interest, showing the kinds of arms employed in our wars at different periods. There are also a few howitzers and field guns, including a Gatling gun, with many different forms of ammunition and projectiles. The Engineer Department is also well represented by models of fortifications, with miniature siege guns in position, enabling one to get an idea of modern de-



CORNER OF POST OFFICE DEPARTMENT EXHIBIT.

fenses. One of the most interesting exhibits in this branch is the group of torpedoes and ground mines used in harbor defenses, recalling the "Maine" disaster most vividly. The Quartermaster's Department makes a very instructive exhibit of dummies clad in the uniforms of the American soldier at different periods of our national existence, including the Puritan soldier of 1620, his Bible in one hand, his blunderbus in the other. A fine equestrian group shows a major-general and two aides, of the present date, in full dress, and near by are the captains of cavalry and artillery. There are also army tents, beds and bedding, cooking utensils, mess outfits, etc. The Signal Corps is well illustrated, and the Medical Department makes a very instructive exhibit from models of hospitals and equipped Red Cross ambulance, down to such details as field medical and surgical chests.

The next space, on the north, is devoted to the five bureaus of the Interior Department. The United States Patent Office display is one of the most extensive exhibits in this department, and it contains many striking features. A working linotype machine is doubtless the main attraction, and whenever it is in operation it is surrounded by groups of admiring visitors, who apparently never tire of witnessing the working of its complicated mechanisms. The cast type-lines, hot from the assembled matrices, and ready for printing, are passed from hand to hand among the lookers-on and the various steps in the work of producing them fully explained.

Many of the patent exhibits have an historical interest as illustrating the progress of invention in familiar lines. The sewing machine may be taken as an illustration, the models showing the earliest forms of machines, together with the crude attempts at invention

ONE OF THE WEATHER BUREAU INSTRUMENT TABLES.

made before the sewing machine became a substantial reality, and so on down to the latest modern device. The typewriter, the printing press, agricultural implements, and many other labor-saving machines of the present day are thus shown in series, enabling the visitor to study step by step the improvements of a decade or a century. A wide range of invention is thus illustrated. from musical instruments to firearms, ordnance, and explosives.

The United States Geological Survey exhibits, first, a wall series of geologic and topographic maps. Second, a series of relief maps and geologic models, including large models of the State of Nebraska and the Yellowstone National Park. The Yellowstone Park is also represented by sixteen photographic transparencies, illuminated by electric lights, and by two cases of specimens illustrating its geology. Two cases of rare minerals and one of fossils complete the survey display. The Bureau of Education has for its principal duty the collection and diffusion of educational information, but it also administers the schools of Alaska, and exercises a limited supervision over the expenditures of the moneys appropriated to Land Grant Colleges under the Morrill act of 1890.

All three of these functions are most completely illustrated in the space devoted to educational matters, the Alaska exhibit, with its lay figures, and natural history specimens, proving especially attractive to the masses who throng the government building in quest of novelty. An Alaskan sled outfit, drawn by a reindeer, over a platform covered with artificial snow, is a prominent object facing the main aisle.

The exhibits of the Smithsonian Institution and National Museum occupy nearly one-half of the northeast section of the building, beginning at the main entrance.

The exhibition of the Smithsonian Institution proper occupies a quadrant under the dome, and its handsome installation material, painted in a soft greenish gray, is in strong contrast to the mahogany cases beyond in which the National Museum exhibits are displayed. The exhibits as a whole tell the story of the founding and perpetuation of the Institution, notable among which are many personal relics of Smithson, a cast from the bronze tablet recently placed upon his tomb in Genoa, Italy, and a complete set of the publications of the Institution and its many bureaus. There are several copies of the history of the first half century of the Institution in different bindings—a most valuable document and a superb exhibit of the printer's art as well.

The exhibit of the National Museum proper is one of the most complete and interesting that has ever been made. In preparing this display, two principal objects have been considered: to indicate the comprehensiveness of the scope of the Museum and to represent the manner in which series of objects are arranged, labeled, and displayed in the Museum at Washington. The cases and general installation materials, for the most part, were brought from Washington, though some special features have been introduced that are new. The exhibit is arranged in three grand divisions, namely, the Departments of Anthropology, Biology, and Geology. Space will not admit even of an enumeration of the subject material in the three sections of the Museum display, and a few examples therefore, briefly stated, must suffice.

The group of anthropological exhibits is intended to illustrate the achievements of the race along a few of the more important lines of activity. Each series of objects epitomizes the subject treated, and presents the leading steps of progress in the simplest possible manner. Here is the story of fire making and illumination: The discovery of the use of fire and the making of fire by artificial means is illustrated by a single series of objects. The story begins with the fire of volcanoes and lightning, is followed by the kindling and keeping of fire, and closes with the utilization of the electric spark. Illumination is represented by two series: (1) the torch, (2) the lamp.

In like manner are completely illustrated the subjects of tools and utensils, weapons, ceramic art, and metal working, musical instruments, land and marine transportation, sculpture and stone shaping, book making, electricity, and many others.

The Department of Biology covers the entire field of zoology and botany. In selecting a topic for illustration in the small space available, two ideas have been in view: first, to present a series of objects significant in itself and at the same time likely to be of especial interest to visitors to the Exposition; and, second, to have this series sufficiently diverse in character to show the various methods Employed in the department. It comprises the characteristic animals of the salt and fresh waters of North America, from the lowest to the highest forms, and the principal types of sea weeds.

The Department of Geology is in several divisions, as follows: Systematic and applied geology, mineralogy, and stratigraphic paleontology, the latter embracing three sections, as paleobotany, invertebrate fossils, and vertebrate fossils.

The Department of Justice has a small space between the National Museum and Navy exhibits, chiefly devoted to portraits of Attorney-Generals of the United States, important departmental publications, law books of the present and past centuries and papers and objects referring to important periods in the history of our country. In the department of prisons and prisoners there are many objects illustrating prison manufactures, including work of individual prisoners, such as embroideries, carvings, and the many curious objects denoting skill and patience that are produced where time is of little value.

The Navy Department exhibit of models of our navy is one of the most interesting and instructive exhibits of any in the Government building, for they include first and second class battleships, cruisers, gunboats and the smaller fighting vessels, among which the "Katahdin" and the "Vesuvius" are prominent. These models are from 3 to 6 feet in length, and cost perhaps $3,000 to $5,000 apiece.

Near the wall is a full-sized model in section of a 13-inch gun, surrounded by projectiles of various sizes, from a 13-inch shell down to those employed in guns of small caliber. There are a few light machine and rapid-fire guns, small arms of every description, and other exhibits illustrating every branch of the service, which are studied with interest. Lieut.-Com. F. M. Stedman is the representative of the Navy Department. Perhaps the most striking and attractive exhibit in this section is a $2,000 model of a naval dry dock, built to scale. It represents the type and size of docks to be built at Boston, Philadelphia, Portsmouth and Mare Island. A model of the battleship "Illinois" is floated into the dock from a tank and the whole process of docking is illustrated. The illustrations used in this article, it is hardly necessary to state, are from government negatives.

PORTION OF PATENT OFFICE EXHIBIT.

Regarding the government exhibit as an educator, it is worth all the money it has cost the United States, for among the daily throng of visitors the most superficial mind must carry away some impressions of the meaning of the term "The Government" that will make the man a better citizen.

THE OFFICIAL REPORT ON THE WRECKED SPANISH WARSHIPS.

We have before us the full text of the official report of the naval board appointed by Admiral Sampson to investigate the condition of the wrecks of the Spanish fleet now lying on the Cuban coast. Accompanying the report are a series of photographs and a set of drawings showing the location of the shot holes on each vessel. In our issue of July 30 we gave several illustrations, reproduced from photographs taken the day after the fight, when the ships were still burning, which gave a vivid impression of the destruction wrought by our shell-fire and by the conflagrations which it started. It is not necessary to reproduce any of the photographs which accompany this report; but we present the four official diagrams showing the number, location, and size of the hits on each cruiser. They are of extreme interest, and those of our readers who are following closely the naval events of the war will find these diagrams of special value for future reference.

In order to expedite the examination and render it as complete as possible, the board was divided into committees to consider the subjects indicated below:

Condition of hull and practicability of saving the vessels.

Condition of ordnance equipment, magazines, etc.

Condition of machinery and boilers.

Effect of gun-fire upon the enemy's vessels.

"INFANTA MARIA TERESA."

The vessel lies nearly upright, and is down by the stern about five feet. She rests easily, bearing throughout the greater part of her length upon a firm coral sand bottom.

The examination of the structure extended to the protective deck. The frames above water are practically intact, and are doubtless so below water. The deck-beams above water are warped by the heat. The end bulkheads above the protective deck are badly warped by the heat of the fire; but the bulkheading below the protective deck, both longitudinal and transverse, is doubtless intact. The outside plating of the vessel is practically intact; but the heat has warped all the deck-plating above the protective deck. The board considers that, taking full account of the distribution of the weights and the strains involved, and taking full account of the reduction of strength, as pointed out, it is considered that with an intact condition of internal structure below the protective deck, the remaining structural solidity is adequate for the stresses liable to be encountered in wrecking the vessel and those liable to be encountered in any except severe conditions of navigation. There are no indications of external explosions, and all deformations can be accounted for by the heat effect of conflagration.

The 11-inch guns and mounts are in excellent condition, but eight out of the ten 5½-inch guns require new breech-blocks. The secondary battery of 6-pounders, however, is badly burned. The engines are covered with water to within six inches of the tops of the cylinders, but they do not appear to have been struck by exploding shells, and there is reason to believe that, if the vessel is raised soon, both the engines and boilers can easily be put in serviceable condition. As our readers are aware, the wrecking operations are being pushed in the endeavor to save this vessel.

Effect of Gun-Fire.—The "Maria Teresa" was struck twenty-nine times, as was also the "Vizcaya." More than half of the hits were by 6-pounder shells, though it was the larger shells that wrought the greatest destruction. An 8-inch shell struck the shield of the second 5½-inch gun, passed through it, ranging aft, and exploded. "The effect of the explosion," the report says, "upon almost everything about the decks in that vicinity must have been terrific." Another interesting hit, showing the effect of bursting shell in the coal bunkers, was made by a 5-inch gun, just abaft the after smoke-stack, under the berth deck. It passed through the wing passage and exploded in a coal bunker, ripport side away from the frames, completely wrecking everything in that compartment, and made a large ragged hole about four feet square on the starboard side. They both entered at an angle of about 45 degrees with the normal, ranging from aft forward.

"ALMIRANTE OQUENDO."

This vessel suffered more severely than any other vessel. She was hit 57 times, or twice as frequently as the "Teresa" and "Vizcaya," 43 of the hits being made by 6-pounder guns. The wreck lies uneasily, considerably down by the stern, with a slight heel to starboard. The destruction worked by our gun-fire was completed by fire and magazine explosions. The engines and boilers, however, appear to be intact, the protective deck amidships having apparently done its work well in this ship, and indeed in the case of all four cruisers; but the explosion of the magazines and torpedoes have wrecked the "Oquendo" beyond all hope of saving the ship. The hull is practically broken in two at the forward turret. An interesting structural fact is brought out at this point; namely, that there is a decided weakness at the junction of the forward and midship portions of the vessel, arising from the discontinuity of the protective deck.

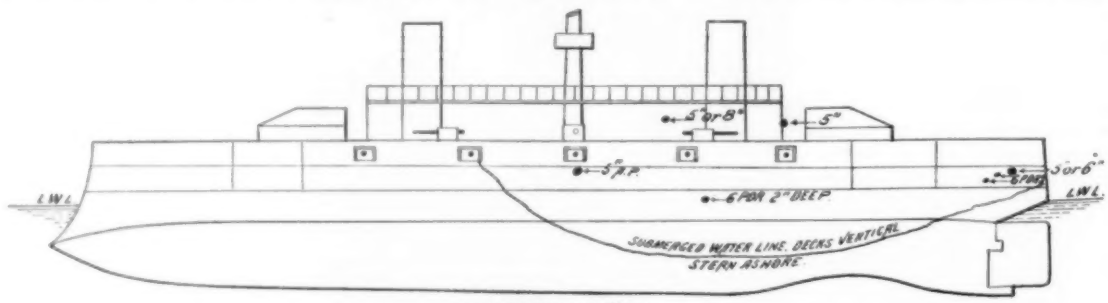
The after 11-inch gun and mount are in excellent condition, and in spite of the fact that its turret was struck, the forward 11-inch gun and mount seem to be uninjured. The 5½-inch battery can be rendered serviceable by the addition of new breech-blocks. One of the after 5½-inch guns was dismounted, and another was penetrated to a depth of 1⅛ inches by a 6-pounder. The 6-pounder secondary battery is badly burned.

As in the case of the "Teresa," all piping and auxiliaries above the protective deck are destroyed or damaged irreparably.

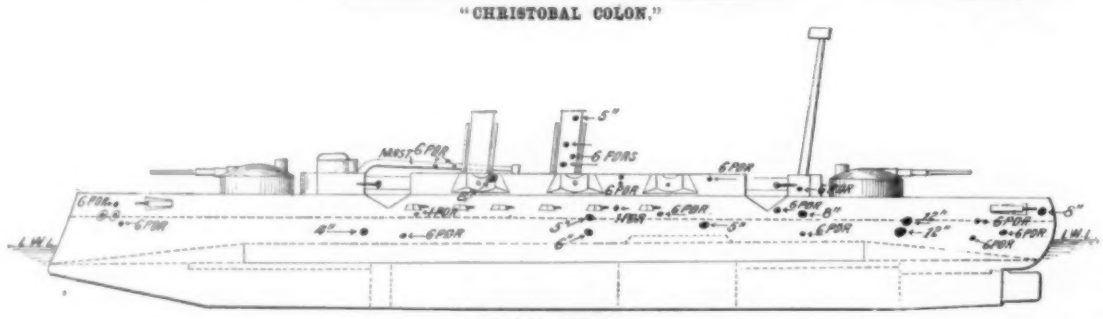
Effect of Gun-Fire.—The effects of the gun-fire upon this ship are described as being "terrific."

"The sides, smokestacks, ventilators, hatch trunks, all seem to have been riddled by shell, by fragments of shell, and by an infinite number of small projectiles. When it is considered that boats which no longer exist were in place and must have been frequently hit, it will be recognized that the effect of this fire was quite sufficient to create dismay among the ship's company besides setting fire to the woodwork. The intense flames to which the three ships were subjected, and the serious explosions of magazines and torpedo heads, caused by the heat of the flames, have so completely consumed all articles and material of inflammable nature that it has been impossible to describe more definitely and in detail the effect of the gun-fires."

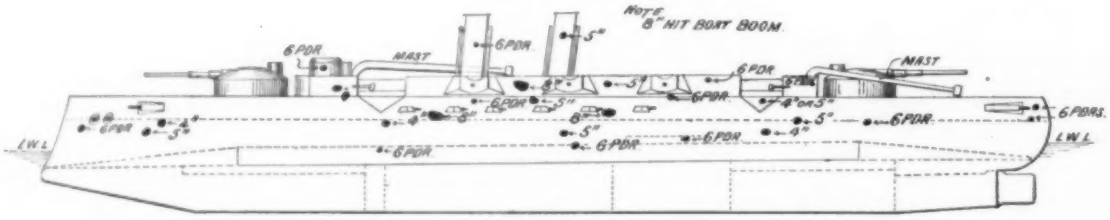
The 8-inch shells demonstrated their destructive power on this ship, one of them striking the hood of the forward 11-inch gun, at the edge of the port, bursting, and evidently killing every one in the turret and disabling the gun. This is a case where the danger of



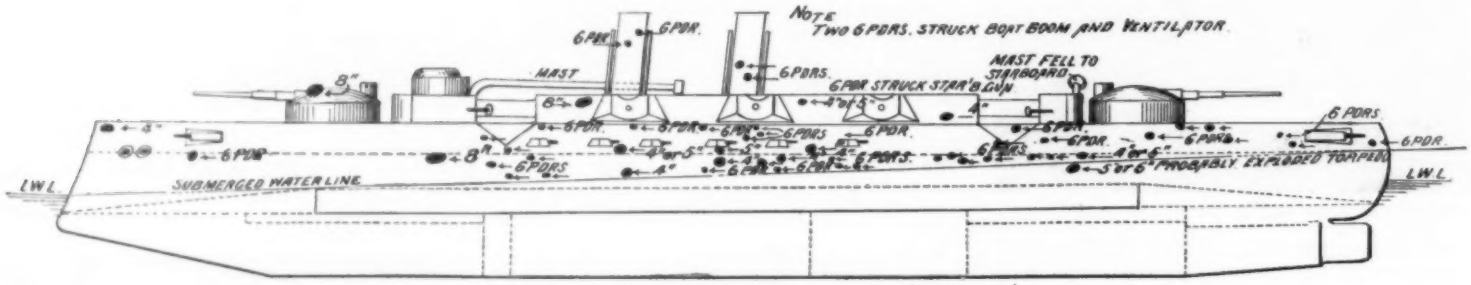
"CHRISTOBAL COLON."



"MARIA TERESA."



"VIZCAYA."



"OQUENDO."

DIAGRAMS SHOWING LOCATION AND SIZE OF HITS ON SPANISH CRUISERS.

carrying a very light shield is demonstrated. Had there been no shield, the shell would possibly not have burst. The Chinese removed these shields from their 12-inch guns to avoid a similar catastrophe.

As evidence that some of our gunners must have got the range and direction with great accuracy, we direct attention to the concentration of shot-holes below the forward 5½-inch gun sponson, where there are seven holes made by a 6-pounder besides one 8-inch hole. Another concentration of fire is seen on the berth and gun decks below the sponson of the after 5½-inch gun, where there are nine hits by 6-pounders. In calculating the effects of these little shells, it must be remembered that they all passed through the unarmored shell of the ship and burst into flying fragments, one 6-pounder being easily capable of killing or disabling a whole gun crew.

It will be seen from the diagram that a considerable portion of the hull above the flotation line was submerged when the examination was made, so that it is probable that a dozen or more hits lay below the water and could not be observed.

The board consider that it "would be most difficult, if not impossible, to save this vessel."

"VIZCAYA."

Although the "Vizcaya" did not suffer so heavily from our gun-fire, she was so badly wrecked by fire and explosions that the board is of the opinion that it is inadvisable to attempt to save her.

So far as can be determined, the boilers and engines are intact, or, at least, not irreparably damaged.

Effect of Gun-Fire.—The "Vizcaya" received a larger proportion of large rapid-fire and 8-inch shells than any other vessel, being struck by no less than 16 of these shells as compared with only 13 hits by the 6-pounders. The effects on the crew were proportionately disastrous, and the report states that "it is evident that the fire of the gun crews of the 'Vizcaya' was very materially lessened and almost silenced by their not being able to serve their guns under the severe fire poured upon them by our ships."

The fact that evidence is lacking of the explosion of *many* of our shell should attract the attention of the Ordnance Department, though it is true that pieces of exploded shell may have struck parts since destroyed by fire.

The number of shell that struck the ship seemed to show by their direction that about one-half struck as she was leaving the harbor—the shell ranging aft; and the other half as she was attempting to run away.

"CHRISTOBAL COLON."

The board found the "Christobal Colon" lying on her starboard beam ends, the stern being about 150 feet from the shore, and her length lying in a direction nearly perpendicular to the line with the beach.

The depth of water at the stern is between five and six fathoms. The bow lies in a depth of about sixteen fathoms.

The deck is quite vertical. The battery on the port side, with the exception of the two forward 6-inch guns, is clear of the water. The forward and second 6-inch ports are submerged. The rest of the gun ports on the port side are out of water.

The bottom valves are supposed to be open. Many of the watertight doors were closed by the crew of the "Oregon" before the vessel capsized. The bilge keel is exposed, and also the port propeller and the propeller shaft.

There is no deformation visible in the deck or outside plating, except some dents where rocks had touched the bottom, and there is no evidence of the vessel having sustained any structural injury. The extensive side armor will prevent local injury to the sides now bearing on the bottom, and the board believed that with the integrity of the skin plating and of the decks and transverse bulkheads, the vessel can sustain herself in her present position, even in a heavy surf, without injury.

Lieutenant Hobson is now engaged in the effort to raise this ship, and should he be successful she will form a most valuable addition to our navy. The "Christobal Colon" was by far the best cruiser in the fleet.

The total number of hits that can be counted on the "Christobal Colon" is 8 or 9; but as only a small area of her sides is open to inspection, it is reasonable to suppose that she was hit more frequently than this. The most interesting hit was made by a 5-inch armor-piercing projectile, which struck the steel armor at the junction of No. 3 6-inch sponson at an angle of about 45 degrees, and after penetrating nearly through, rebounded. The hits on this vessel were chiefly received during the long chase by the "Brooklyn" and the "Oregon."

The conclusions drawn by the board from its examination are as follows:

That the use of wood in the construction and equipment of warships should be reduced to the utmost minimum possible.

That loaded torpedoes above the water line are a serious menace to the vessel carrying them and that they should not be so carried by vessels other than torpedo boats.

That the value of rapid-fire batteries cannot be too highly estimated.

That all water and steam piping should be led beneath the protective deck or below the water line and fitted with risers at such points as may be considered necessary.

ANALYSIS OF GUN-FIRE.

It is estimated that about 6,000 shells of all sizes were fired during the Santiago engagement, of which all but such as were aimed at the two destroyers, during the brief time that they remained afloat, were fired at the four armored cruisers. The diagrams of the shot holes show a total of only 123 hits as having been made on the metallic structure of the vessels. At first sight this would appear to be a very low percentage for such good marksmen as our American gunners are universally considered to be. There are modifying circumstances, however, which must be considered in connection with the accompanying table analyzing the gun-fire.

1. The first half of the battle, or that in which the "Teresa," "Oquendo," and "Vizcaya" were destroyed, took place under the confusion of a dense pall of smoke, none of these three or of the American vessels using smokeless powder. Moreover, what gentle breeze there was, blew off shore from the Spanish to the American fleet, bearing back both their own and the Spanish smoke upon the American gunners.

2. The smoke rendered it difficult to get the range of the Spanish vessels.

3. The diagrams show only the shot holes that were visible above water after the cruisers had settled more or less in the water.

4. There were a few hits on the starboard side that do not appear in the diagrams.

5. The woodwork having been all burned away, it is possible that the evidences of some hits have been obliterated—such, for instance, as may have been made by shells fired at considerable elevation from long range and have fallen on the decks or superstructure without penetrating the side plating.

ANALYSIS OF HITS ON SPANISH CRUISERS.

Size of gun.	Number of hits on each vessel.				Total number of hits by each caliber of gun.	Number of guns of each caliber in action.	Number of hits per gun.
	Teresa.	Oquendo.	Vizcaya.	C. Colon.			
6-pounder	17	43	13	4	77	43	1·83
1-pounder	2	..	..	..	2	13	0·15
4-inch	1	7	4	..	12	3	4·00
5-inch	3	3	7	2	15	6	2·50
6-inch	1	1	..	1	3	7	0·43
8-inch	3	3	5	1	12	18	0·67
12-inch	2	..	..	..	2	6	0·33
13-inch	..	..	..	..	..	8	0·00
Totals	29	57	29	8	123	103	..

Of the 123 hits recorded, 77, or more than one-half, were made by 6-pounders. Then come the 5-inch rapid-firers of the "Brooklyn," which evidently did splendid work against all the vessels, but especially against the "Vizcaya," where seven 5-inch shells got home. The next largest number of hits is to be credited to the 8-inch and the 4-inch rapid-fire, the latter guns on the "Iowa" landing 12 shots. The 6-inch scored three hits, the 12 inch two hits, and the great 13-inch guns probably never landed at all. If they had, the mark of their 1,100-pound shells would be plainly visible on the vessels.

In studying the accompanying table of percentage of hits per type of gun, it is remarkable how closely the results agree with the forecasts as to what would happen in a naval engagement. On the theory that there will be a large number of misses for one hit, it is readily understood how the 13-inch guns failed to score a single hit—they did not fire often enough. Moreover, of the larger-calibered guns above 4-inch, by far the highest percentage of hits per gun was made by the guns of the rapid-fire type, namely, the 5-inch rapid-firers of the "Brooklyn" and the 4-inch rapid-firers of the "Iowa." Another curious fact is that if the percentage figure (0·43) for the 6-inch slow-firers be multiplied by the respective rates of fire of the 4-inch and 5-inch guns, the result gives very closely the percentage of hits recorded for these guns, namely, 4 and 2·50.

We should naturally expect, arguing along the same lines, that the 6-pounder, on account of its very great rapidity of fire, would have shown the highest percentage of hits per gun engaged; that it does not is due, probably, to the fact that some of the fighting was done at ranges which were rather long for guns of such small caliber.

THE GUNDALOW WITH LATEEN SAIL—A RELIC OF EARLY DAYS.

THE GUNDALOW.

To one who has had a passionate fondness for boats, who has sailed in all kinds of craft, from rowboat with homemade sail to yacht and coasting schooner, certain occasions stand out as real epochs in life. One may be the first sails in the easy-steering dug-out canoes and buckeyes of the Chesapeake and Hampton Roads, which glide along so quietly yet rapidly, one of the most interesting relics of the aboriginal life of the Southern coast. Another may be the first sight of a full-rigged ship under full sail on the Atlantic, a picture of incomparable beauty. Then may come the running through a fleet of red-sailed English fishing smacks in a dead calm in the British Channel, the tiny craft in color and contour delighting the eye. The Thames lighters, lying in the upper reaches of the Thames, with picturesque sloping gaff and brailed-up sail, or with their red sails spread driving up the river off Rochester and Greenwich, or beating like a fleet of yachts up the Medway, hold a warm place in the memory. Standing on the bridge at Rochester, near neighbor to or successor of the one on

which Mr. Pickwick and the dismal man held converse, the writer learned to admire the Thames lighter, craft sacred to the memory of Jacob Faithful, and he still hopes to sail on one. The Venetian boats with painted sails, slender bowsprit and decorated bluff, high bows, the sailing gondola, and the hours spent in learning the mysterious art of gondoliering, when the oar persisted in slipping out of the shallow notch in the forcola, or rowlock, all are golden memories. A sail in the harbor of Levorno on a lateen-rigged open boat, the distant view of a felucca from the Riviera, bring to mind a railroad trip from Newburyport to Portsmouth, N. H., taken simply in the hope of seeing a gundalow, the only American representative of the Mediterranean felucca.

These interesting craft are nearly extinct. By special effort we secured the view shown of the gundalow "Fanny M." She was built in 1888. She is sixty-nine feet long, eighteen feet six inches beam, and four feet draught. The short mast rises twenty feet from the deck, and carries the great yard, sixty-eight feet in length, counterbalanced by iron weights at its lower end. There are 259 yards of duck in the sail.

We are indebted to her owner, Capt. Edward H. Dunham, for the following notes on gundalows, which form a most valuable contribution to the history of naval progress on this side of the Atlantic.

Gundalows were used on the Piscataqua and its branches before the revolutionary war. Gen. John Sullivan at the time of that war, with some men, boarded one at Durham in the night time, and went down twelve miles to Forts William and Mary, at the mouth of the Piscataqua, and captured a quantity of powder from the British. Returning to Durham with it, they hid it under an old church, whence it was drawn by ox teams to Concord, N. H., and Bunker Hill, Mass., arriving in time to reinforce the supply used in those momentous times.

They were short decked, bow and stern open, where the freight was carried and propelled by long oars and poles. These were not run with a sail, but later on they were rigged to sail with a short square affair to go in a fair wind.

The first one to go with a lateen sail was rigged by Dyer Foye, of Dover, N. H., about fifty years ago. They also then had a leeboard and rudder.

The ones rigged with square sail were pulled around with oars like a raft. The first boats had no rudder to steer by. A notch was made in the stern in which a steering oar was placed.

About forty years ago they were constructed with full deck. Since then the cargo has all been carried there. Sideboards are fastened up by means of hooks to form bunkers when coal is to be freighted.

Probably the lateen sail was taken from that style of sail used on a boat called a packet which was used to carry cotton to Exeter, Durham, Dover, New Market, and the heads of the streams from Portsmouth, returning thither with provisions. It was a short deck, keel boat. These were in favor, as the sail was portable in passing under the bridges.

It is true that there are very few gundalows left at all and only two that sail, one of which is shown in the cut. The reason of this is the large size of the boat of to-day, some carrying from fifty to one hundred tons. The average tonnage of the old time ones was about twenty tons, and the difficulty of navigating the large modern gundalows in the strength of the current which runs very swiftly is very considerable, especially through Dover Point Bridge, which was constructed in 1873-74. This is considered one of the hardest passes to navigate in the country, as the current runs counter and few care to undertake the task.

The few that do not sail are towed by small steam tugs, which makes the business from a lucrative standpoint less attractive than formerly.

The Rays of the Glow-worm.

The pale green light that shines from the posterior portion of the so-called "glow-worm" is said to be due to the emission of X rays. By the way, this creature is not a worm at all, but the wingless female form of a species of beetle, the Lampyris noctiluca, and her luminosity is supposed to afford the means of attracting the non-luminous male.

Recently three hundred of these insects, according to the Revue des Sciences, were made the subjects of experiment by inclosing for two days in a dark chamber, sheltered from all foreign lights, and placing before photographic plates screened by several thicknesses of black paper, besides plates of brass, copper, and aluminum; also a piece of cardboard with a hole in it was interposed between the plates and the photographic plate. On developing the latter, it was found to be blackened, except at the part opposite the hole in the cardboard. The rays of the Lampyris, therefore, appear to have penetrated the metal and excited luminosity in the cardboard. It was subsequently discovered, also, that when there was nothing between the sensitized plate and the "worm," the rays acted as do those from ordinary light, but in traversing cardboard and certain metals, they acquired the properties of the Roentgen rays. It is suggested that possibly these creatures have the property of emitting both forms of rays.

The foregoing savors somewhat of the improbable, and the editor of the Revue suggests further and more definite experimentation; he also adds, as regards the power of emitting dual forms of rays, that there may be a third form that will prove explanatory.

Oiled Clothing.

A suit of oiled clothing such as is commonly worn by sailors, consisting of a coat and a pair of trousers, costs from $1.50 to $2.50, according to the quality; an oilskin sou'wester costs 25 to 50 cents. There are many makes of oiled clothing, including some whose trademarks have been familiar for many years. The oilskin coat hanging outside the outfitting and supply stores in streets along the water front has long been a familiar sign, says The New York Sun.

The life of an oilskin suit depends, of course, primarily upon the wear to which it is subjected, but largely also upon the care taken of it. An oilskin suit will last longer and keep much better if hung up when not in use than it will if rolled up, but it may be that the user has no place to hang it, or that he keeps it rolled up to be ready to carry with him at any time as a pilot would do. In dry latitudes, where a sailor has less occasion to wear them, his oilskins, if cared for, would, of course, wear longer than where they were often worn. Usually, the average life of an oilskin suit worn by a sailor would be about a year.

When a sailor's oilskins crack or get worn so that they are not waterproof, he oils them. They may need oiling two or three times a year. There are prepared oil dressings made for this use and put up in little tin cans. Some sailors use oils of one sort and another, and some sailors make a mixture of their own for a dressing. The sailor is likely to have a preference for some one brand of clothing and to stick to it. And he has his own ideas as to the best dressing for it, but he carries always with him a dressing of some sort. It is put on with a brush, the garments being hung up and painted with it.

Oilskin coats worn aboard ship by men before the mast are cut short, so as not to interfere in any way with their movements. The coats worn by the officers of a ship are cut longer. The officers in some cases wear rubber coats, but the oilskin is the coat they commonly wear.

While oiled clothing and the traditional sou'wester are most familiarly associated in the mind with ideas of sailors and of the sea, they are also, as a matter of fact, very largely and extensively worn upon the land by truckmen and car drivers, and many other outdoor workers and by sportsmen.

Cycles for Farmers.*

Appreciation of the bicycle has penetrated so deeply into the whole American public that one dollar wheat is likely to mean a great deal to the cycle trade, on account of placing cash money in the hands of a large class of the population whose purchasing capacity has heretofore been limited. "Kansas City, perhaps the most important market for agricultural implements in the country," says one of the commercial agencies in its weekly summary of conditions, "reports the demand exceeding all records and sales limited only by the ability to deliver orders." The West needs agricultural implements and, having the money, buys them. The rural population in the Eastern and Central States is better provided with the tools of agriculture and has less need of investing the money obtained from the sale of grain in this line of goods. The indications of unusual prosperity are therefore less pointed among farmers in the older States, but there is no reason to doubt but what a very gratifying amount of money is in circulation in country districts all over, and will be expended in part for a commodity like bicycles, which satisfies nearly all those cravings for fashion, utility, and sentiment that induce men to part with their money.

What preparations should be made for the trade which seems to be within easy reach under these hopeful conditions is a problem which is already occupying the attention of business men who have made it their particular line to supply rural trade. Catalogue and mail order houses are early in the field with cheap bicycles and undoubtedly will reap a harvest. Great efforts are visible in the advertising columns of country newspapers on the part of dealers in second-hand cycles, and these, too, will probably be rewarded by a good trade. The most salient point in the situation seems to be the fact that the affluence of the rural class is something already in operation and more strongly felt in general trade at the present moment than it is likely to be at any later period of the season. Nearly everybody has sold his wheat and has the money where it is instantly available. As time progresses there will be less to spare for purchasing cycle goods than there is now, and thus it seems to become the proper policy for manufacturers and agents to train their batteries on the new possibilities with as little delay as may be, and get a stock of suitable goods on hand ready for the very first manifestations of the demand which appears coincidently with mild weather in each locality.

Dealers in small towns probably have it in their own hands to decide whether the business which is in prospect shall be done by them or by the department store in the nearest larger town. Unless they make a special effort to impress their rural neighbors with the merits of their line of goods and are fortified with a respectable assortment of stock to choose from, it is easy to predict that the real advantage which they may be able to offer to customers will be looked upon lightly by the class of people under contemplation, whose inexperience in cycling affairs makes outward appearances all-powerful for business purposes.

In certain territories the great need of immediate action, which is due to the momentary prosperity of the agricultural class, has apparently been realized, for dealers in these localities have lately been sending in many rush orders of goodly size, although previously they were found so callous to the arguments of the traveling salesman as to drive this usually suave and hopeful individual to despair. But in other localities that are blessed with very similar possibilities for a brisk business the agents are still sitting with their arms folded and looking unutterably suspicious when a reasonable wholesale price is mentioned. They may have determined to leave the bicycle business and allow it to drift into stronger hands than their own; but if this is not their plan, it would seem worth while for them to consider if there is likely to be any other period in the year 1898 when their chances for profitable trade will be as bright as just now. Having to deal largely with a new class of buyers and competing with large stores in the nearest large city, their success must depend upon their ability to impress the public forcibly with the commercial inducements at their command, so that the comparison which the rural customer draws between him and the large city store shall not be altogether in favor of the latter, but shall at least leave a lively doubt for his benefit on the score of intelligent selection of models and responsibility for their workmanship.

In this matter of helping the minor agent to hold up his head and maintain his commercial prestige in spite of a small stock and meager displays, manufacturers have done little, but the prospects of a rushing cash business which is most likely to go to the dealers that make the greatest showing and the smallest prices may perhaps this year induce a new order of things.

* The Cycle Age and Trade Review.

The Current Supplement.

The current SUPPLEMENT, No. 1184, contains a number of articles of unusual interest. "The Design and Construction of a Sensitive Laboratory Balance" is another practical article by N. Monroe Hopkins, who two weeks ago described an electrical furnace for the use of amateurs. With proper attention to the instructions any amateur can make, within a week's time, a balance which will be as good for all practical purpose as one for which he would have to pay $125. The balance described is so delicate that when the pans are fully loaded they will turn, with the addition of one-quarter of a United States postage stamp, to either side. The article is accompanied by eight illustrations, giving the various steps in the manufacture of the beam, etc. We are sure that many of our readers will like to have a fine balance for laboratory use if they could make it themselves at small cost. "American Progress in English Industries" is referred to elsewhere editorially. "Something About Brass Furnaces" is an article which will interest all brass founders. "Prince Henry of Prussia, in China," is a handsomely illustrated article showing the summer residence of the Emperor of China. The late French architect Charles Garnier has an appropriate biographical notice accompanied by a portrait. "Experiments with Currents of High Tension of Great Frequency" describes a number of curious and interesting experiments. "Acetylene Burners" is an article giving detailed illustrations showing the construction of several leading types of acetylene burners. "Glacial Geology in America," by Herman L. Fairchild, is continued. This is an important address delivered before the Boston meeting of the American Association for the Advancement of Science.

Contents.

(Illustrated articles are marked with an asterisk.)

RECENTLY PATENTED INVENTIONS.

Mechanical Devices.

LOCK.—EDWARD FACKNER, New York city. The purpose of this invention is to provide a lock which is simple in action and durable in construction. The lock has a casing in which a fixed partition is located. In the casing a spring-pressed bolt is arranged at the front side of the partition. This bolt comprises a rod movable through the partition, three brackets rigidly held in the casing at the rear side of the partition, and two independent tumblers, alternating with the brackets. Each tumbler is capable of engaging the rod to hold it. In connection with each tumbler, a key-rod is used and operated respectively at the opposite sides of the casing. By the arrangement described, the door can be locked from the inside, so that it cannot be opened from the outside, one tumbler being merely left in its normal position.

APPARATUS FOR SHUFFLING CARDS.—JOSEPH BOOTH, New York city. The present invention provides an apparatus in which the intermixing of the cards is performed far more thoroughly and expeditiously than by hand. In the apparatus in question, the cards to be shuffled are introduced into the mouth of a casing containing the operative mechanism and fall through guide-passages upon a series of horizontally movable tapered fingers. These fingers are attached to a narrow strip having rounded notches in its upper edge. The fingers are inclined downwardly from base to point, and have a flat bottom and vertical side flanges, the upper edges of which are toothed. The cards falling through the passages are arrested by the strip, in the notches of which they temporarily rest. A separator being released, the cards slide off upon the fingers, whence they are discharged. The cards being supported evenly in the same plane and being restrained by the tooth d flanges, they fall off one by one, so that they are delivered well shuffled in the receptacle at the base of the apparatus. Thus by a simple, highly efficient device, cards may be intermixed more thoroughly than is usually done in shuffling by hand.

AUTOMATIC PLAYING-CARD SHUFFLER.—JOSEPH BOOTH, New York city. The purpose of this invention is to provide an apparatus for shuffling cards whereby all players are placed on the same plane of equality, whereby any advantage gained by using marked cards is nullified, and whereby a more complete shuffling is attained than is usually accomplished manually. The cards introduced in the casing are divided into three equal parts. Each part is temporarily arrested and supported by one of the tapered fingers of a separator. A spring gear which has been placed in operation, acts to force the separator or shuffler slowly backward, in which operation the cards fall successively off on each side of the fingers and drop into a tapering condenser, slotted in its entire width to allow the cards to pass. In the present invention, as well as in the preceding, it will be observed that the cards are not intermixed by twos and threes, but one by one, attaining thus a more perfect shuffling than has been hitherto possible.

SPOUT-HOISTING APPARATUS.—HENRY F. KUSS, Escanaba, Mich. This invention provides an apparatus for raising and lowering spouts used for discharging material from a wharf into a boat. By means of this apparatus the pulling leverage will be changed with the changing positions of the spout in raising or lowering. The apparatus comprises a drum tapered in both directions, with the smaller diameter near its ends, these tapered portions being each provided with a spiral groove or channel. Cables engage in the grooves and have connection with the outer end of the spout or platform. A tapered and spirally-channeled equalizing drum is mounted on the shaft of the first named drum. The drums are rotated by cranks. A counterbalancing weight has a cable engaging with the equalizing drum. Means are provided for preventing the weight from swinging outward to strike a boat or the like.

GRADER AND SCRAPER.—CALVIN KARRAKER, Dongola, Ill. The object of this invention is to provide a machine of comparatively few parts, that will reduce the amount of labor required in grading or excavating. The machine is constructed so that it may be adjusted to different widths of road. The ditcher and grader comprises a carriage and a frame mounted to swing vertically with relation to the carriage, and consisting of side sections. Each section consists of two parts adjustable longitudinally, one part on the other. From the shafts to the side-pieces of the frame, braces extend, which are slotted at their inner ends. A bolt extends through the slots of the overlapped inner ends of pairs of braces. The ground-breaking devices are operated by the wheels, which in turn are operated by a series of sprocket wheels driven by a traction engine.

PLANTER.—JOHN S. EARHART and CHARLES MILLER, Millersville, Ill. This invention provides improvements upon the construction of a planter patented by the same inventors. The improvements in question relate particularly to the connection between the seed-drop mechanism of the three seed-boxes and to the means for adjusting the central seed-box so as to cause the seed to be planted more or less deeply. The seed-box is provided with a supporting frame and with a runner. Side-pieces on a frame are connected at their rear by a cross-piece, and have upwardly-extending forward ends pivotally attached to the supporting-frame of the seed-box. A wheel is journaled in the rear portion of the pivoted frame and a lift-lever is connected with the pivoted wheel-carrying frame. By operating the lever the frame will be raised or lowered, and the wheel will be carried toward or away from the ground, thus regulating the depth at which the runner shall enter the ground.

Railway Appliances.

CAR BRAKE AND FENDER.—OLIVER B. WHITNEY, Marlborough, N. Y. This car-brake and fender is designed to bring a car almost instantly to a standstill, either at the option of the driver or when an obstruction passes into the fender. The car-brake is provided with a shoe adapted to pass between a wheel and a rail. A link carries the shoe normally in the path of and out of contact with the wheel, and is arranged to allow the shoe to move down into a resting position on the track in advance of the wheel to permit the latter to run onto the shoe. A spring-arm extends forwardly from the shoe. Fixed stops on the car-frame hold the shoe in place, one of the stops being adapted for engagement by the arm to guide the shoe forward and upward to a normal, inactive position.

EMERGENCY-CROSSOVER.—FRANK R. COATES, Stamford, Conn., and ORRY M. SHEPARD, New York city. This emergency-crossover has a point-rail formed of T-rail, with the web and base cut away at one end at an angle so as to fit against the side of the track-rail. The head extends over the head of the track-rail and is beveled to form an incline for raising the wheels so that their flanges will clear the track-rail. A plate is fixed to the bottom of the point-rail, extends in the direction of its length, and is adapted to rest upon the tie and to support the point-rail at the proper elevation.

Miscellaneous Inventions.

TRIPLE VALVE.—JOHN V. WELLS, Wilmerding, Ill. The purpose of this invention is to provide a triple valve which does away with the necessity of releasing the brakes to recharge the auxiliary reservoir, the reservoir being at all times fully charged in case of an emergency. The triple valve has a valve-body with two ports independently connected with the brake-cylinder. A slide-valve is arranged to uncover one of these ports to connect with the auxiliary reservoir on an emergency application. The slide-valve is provided with a port having a spring-pressed valve near one end and opening at the other into a recess at all times in communication with the train-pipe pressure. The port in the slide-valve is adapted to connect the other port in the valve-body with the train-pipe pressure.

SYRINGE-NOZZLE.—FERDINAND KING, New York city. This syringe-nozzle consists of an approximately semispherical body having its outer or front end curved downwardly, forwardly, then inwardly, and extended within the body to form an inwardly extending projection. This projection is spaced from the body and forms therewith a longitudinally curved annular chamber. The inwardly-curved front portion of the body is perforated, whereby the spray delivered from the nozzle will converge toward the center of the nozzle and meet at a short distance in front of it.

FOLDING-BED.—CHARLIE E. YEAGER, Prairie Creek, Ind. The object of this invention is to provide a combined bed and bureau which may be quickly adjusted, and which, when not in use, will present the appearance of an ordinary article of furniture. The bed comprises a head-section, a foot-section, a bed pivoted to the foot-section and sliding into and out of the head-section and a spring secured to one of the sections. This spring is detachably interlocked with the other section, whereby it may be adjusted to assist in the folding operation or may be released to prevent such operation accidentally. By means of a drag-line extension, the spring may be connected and disconnected.

HOE-SLING.—ALLEN J. CARLEY, Belmont, La. To provide a device which is adapted for use on rakes, hoes, or long-handled shovels, and which is designed to save much labor, this inventor has arranged a sling comprising a shoulder-strap with elastic sections. A hanger-section is also provided, which has its upper end buckled to the elastic sections at the ends of the shoulder-strap. The hoe is attached to the lower end of the hanger-section by means of a strap.

CHART-TABLE.—SILAS N. GREENLEAF, Seattle, and HENRY BARKER, Hoquiam, Wash. The chart-table provided for by these inventors is designed to hold charts or maps in place for convenient inspection on board a vessel or other place, the table and map being constructed to be readily folded and stored when not in use. The table has a top consisting of slats arranged closely together and held in place by some flexible material secured to the upper surface of the slats. A smooth, unbroken top-surface is thus provided when the table is in use. One edge of the top is hinged to a support. Supporting-arms are hinged to the support. Flexible straps hold the chart on the table top. In rolled position the top is held by a strap.

COAL-CHUTE.—JAMES S. CHEW, What Cheer, Ia. This coal-chute is of peculiar construction and is arranged to divide the stream of coal and to direct it into any of a plurality of passages, so that two or more vehicles may be loaded simultaneously from one chute. The coal-chute has two branches, a post mounted at the meeting walls of these branches and a deflector having a jaw loosely embracing the post. The deflector is mounted to swing on the chute to command each branch thereof, and the jaw serves to shed the coal past the post.

BURGLAR-ALARM.—DANIEL L. WARTZENLUPT, Kutztown, Pa. The alarm devised by this inventor is an electrically actuated burglar-alarm. By jarring or breaking a window-pane, door-panel, transom, or the like, the circuit is closed and the alarm sounded. The wires of the circuit are extended across the window and are connected with the alarm. A circuit-closer is mounted to swing on one of the wires and adapted to close the circuit when swung out of its normal engagement with the window.

Designs.

GAME-BOARD.—FRANK B. WELLS, Masonville, N. Y. This design consists of a box-like body in which there is a horizontal partition above the bottom provided with pockets at diagonally-opposite corners of the box-body, each pocket having an opening. In each of the other two corners, and in the center of the partition, openings are also made. Balls are placed in the pockets and the board is to be tilted so as to roll the balls into the proper openings.

TIRE REPAIRING PLUG.—ABRAH J. WHISLER, Kokomo, Ind. The plug-stem in this design is provided at its lower end with an upwardly flaring rim, the outer side of which tapers at its lower end to a point. This rim extends upwardly to a point on a level with the upper end of the stem, the space within the rim being conical and extending from the lower end to about the level of the upper end of the stem.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for 10 cents each. Please send the name of the patentee, title of the invention, and date of this paper.

Business and Personal.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.
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Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(7485) **W. A. T. writes: Will you kindly** inform me as to the number of pounds of gun cotton or explosives used in the 13-inch shell? A. The 13-inch shell is charged with 70 pounds of brown powder.

(7486) **O. S. K. writes: I believe I saw at** one time in your publication the method of placing an egg in a bottle. Think some acid or something was used to soften the shell and then the egg was placed through the neck of the bottle. A. In order to make eggs enter a decanter or a bottle, it is necessary to soak an egg for about twenty-four hours in acetic acid or strong vinegar. The shell of the egg thus becomes soft, but must be handled with care. It will be an easy matter for the egg while in this state to enter the mouth of the bottle. It can be helped along greatly by the use of a funnel, as wide as possible as will just enter the bottle. If the egg is now placed in the funnel, it gradually finds its way and by its own weight drops into the bottle. The bottle should be about half full of water, both to check the fall of the egg and to prevent its breaking and at the same time it hardens the shell, which after the operation is very thin, more so than originally. An egg can also be passed half way through a finger ring, and in that condition placed in water, and it presents a very curious appearance—an egg with a ring around its center.

(7487) **C. E. G. writes: Please inform** me how much No. 10 wire for the primary and No. 36 for the secondary of an induction coil will be needed to give a four-inch spark, and how large a core, also how many square feet of tinfoil for the condenser, and what kind of a battery and how many cells will be needed, A. We cannot give you definite quantities for your 4-inch coils. Use two layers of No. 10 wire for primary. For secondary you will do well if you get 1 inch of spark for 1 pound of No. 36 wire. Some makers claim to do better than this. You may have to use 2 pounds per inch of spark. We cannot tell. For battery you can hardly do better than to use the bichromate plunge battery. If you wish to make it, follow pattern in SCIENTIFIC AMERICAN SUPPLEMENT, No. 792, price 10 cents. Six cells, perhaps four, will be enough for your coil. Your core may well be 1¼ inches by 12 inches. The condenser requires about 75 square feet of tinfoil. Probably no two 4-inch coils are alike in all respects, and you may have to try more than once to get a coil giving that length of spark.

(7488) **H. M. J. writes: A question was** raised here in regard to the speed of the "Columbia" and "Minneapolis." Would like to have you answer it in your most valuable paper, which I take regularly. What is the standard official time each makes in knots? What is the greatest speed each has made? A. The greatest speed of both the "Minneapolis" and "Columbia" was made at their official government trials, when the "Minneapolis" made 23·073 knots per hour and the "Columbia" 22·8 knots.

(7489) **C. H. B. writes: Kindly inform** me how to construct a cheap balloon, one that may be used repeatedly, with a lifting power of about eight pounds. What is the size and pitch of the propeller wheels on the torpedo boat "Porter"? A curious fact has attracted my attention, and I have sought a plausible explanation in vain. At Pensacola, Florida, near the seashore are many flowing wells, usually less than one hundred feet in depth. The tide here rises about two feet once a day. When the tide is high these wells flow much more freely than when the tide is low. Some weak wells have been observed to flow only during high tide. If you can explain how the tide can affect water above its level I shall be pleased to have you do so. That it does do so is evidenced daily at this place by the flowing wells. A. An interesting illustrated description of the manufacture of balloons was published in SCIENTIFIC AMERICAN SUPPLEMENT, No. 413, and also a practical paper on balloon construction in No. 726, 10 cents each mailed. A balloon to lift 8 pounds should have a capacity of 125 cubic feet. We have no dimensions of the Porter's propellers. The subway waters near the sea flow into it and are influenced by the rise and fall of the tide in the same manner that sluggish rivers rise and fall with the tide, although their waters may constantly flow seaward. The rise in the tide increases the underground resistance to the constant flow of water toward the ocean. The waters of artesian wells near the sea have their natural outlet at various distances from the shore, according to the depth and formation of the water-bearing strata. Variations of pressure by tidal action over the outlets of such subterraneous waterways will react upon artesian well flow for a considerable distance from the ocean. Ordinary surface wells near the ocean are influenced by the same causes, and are found to vary their water level with the rise and fall of the tides.

(7490) **L. H. M. writes: Will you please** answer in your next issue of the SCIENTIFIC AMERICAN through the Notes and Queries column the following questions: 1. How many and what kind of storage batteries would it require to light 15 incandescent lights, 16 candle power? A. To light 15 16-candle power incandescent lamps, 52 volts, will require 28 cells of 7 plates, each 7¾ inches by 7¾ inches. These will discharge 8 hours at the rate of 15 amperes. This answer is based upon the tables issued by the Electrical Storage Battery Company, Drexel Building, Philadelphia, Pa. 2. Which would be more economical—52 or 110 volts for lights? A. There is no difference in electrical efficiency of 52 and 110 volts. If you adopt 110 volt lamps, you will require 58 cells of battery. The cost of battery will be more than twice as much. 3. What would be the smallest dynamo that would charge the batteries? I want to run the dynamo by water power. A. You will require a current with 70 volts pressure for charging the battery. For the best rate of charge the dynamo should give 30 amperes. This will charge the battery in 4 hours. 4. Would it be possible to make the batteries and dynamo myself, and where could I get information about making them? A. If you are a good machinist, you might make the dynamo; but cells which do not infringe some patent would not be worth much. 5. About what would be the first cost and the after operating expenses? A. We do not know what it would cost you to put in your plant. Probably twice as much to build it as to buy it. The cheapest way is to get a kilowatt machine and light your lamps directly with it. There does not seem to be any need of using a storage battery. You can obtain information about the storage cell from Treadwell's "Storage Cell," price $1.75 by mail.

NEW BOOKS, ETC.

ALTERNATING CURRENTS OF ELECTRICITY AND THE THEORY OF TRANSFORMERS. By Alfred Still. With numerous diagrams. London and New York: Whittaker & Company. 1898. Pp. 184. Price $1.50.

This book has been written, not only for engineering students, but also for those engineers who are but slightly acquainted with alternating current problems, or who, though their practical knowledge of the subject may be extensive, are yet anxious to get elementary but sufficiently accurate ideas of the leading principles involved, which will enable them to solve many if not the greater number of problems likely to arise in practice. The introduction of the higher mathematics has been to a large degree avoided. As this is a very important subject of electrical engineering, the present work will undoubtedly have a large sale.

EASY LESSONS IN MECHANICAL DRAWING AND MACHINE DESIGN. Arranged for self-instruction. By J. G. A. Meyer. Fully illustrated. Volume I. New York: Arnold Publishing House. 1898. Pp. 405. 4to. Price $7.50.

The present work is one of the best works we have seen on mechanical drawing. It is filled with excellent illustrations of the kind of drawings which the draughtsman would be compelled to make in a shop, such as full details of lathes, stuffing boxes, cranks, bolts, etc. Theoretical problems are far from being neglected, however, and a large number of them are scattered throughout the book. The volume with its 500 illustrations is specially adapted for the use of students who wish to acquire a competent knowledge of mechanical drawing at home. The large size of the pages enables the drawings to be reproduced on a large scale and also permits a handsome face of type being used. The book is most creditable in appearance.

A CATALOGUE OF THE SCIENTIFIC AND TECHNICAL PERIODICALS, 1665–1895. Together with chronological tables and a library check list. By Henry Carrington Bolton. Second edition. Washington. 1897. Pp. 1247.

The first edition of this catalogue was published in 1885. The value of Dr. Bolton's service to science is very great. We are indebted to him for the Bibliography of Chemistry and for the present catalogue. They both have been labors of love and have been executed with remarkable accuracy and zeal. It is difficult to know whom to congratulate most, Dr. Bolton for the valuable volume which he has compiled, or the Smithsonian Institution, which has published this work, which could never pay its expenses. It is gratifying to know that we have a branch of the government which is able to take up and publish manuscripts of this kind. The value of the Smithsonian Institution in the increase and diffusion of knowledge is recognized throughout the world.

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AUGUST 30, 1898,

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A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents. In ordering please state the name and number of the patent desired, and remit to Munn & Co., 361 Broadway, New York. Special rates will be given where a large number of copies are desired at one time.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list, provided they are simple, at a cost of $40 each. If complicated the cost will be a little more. For full instructions address Munn & Co., 361 Broadway, New York. **Other foreign patents may also be obtained.**